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# MECHANICAL CULTIVATION IN INDIA

## A History of the Large Scale Experiments carried out by Burmah-Shell Oil Storage and Distributing Company of India Limited.

BY

C. P. G. WADE,

*Office of the General Manager in India, Development Department, Burmah-Shell, Bombay.*




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# FOREWORD.

I have been asked to write a foreword to this Monograph which describes the large scale experiments in mechanical cultivation carried out by Burmah-Shell Oil Storage and Distributing Company of India in Bombay, Hyderabad and Sind. I comply with this request with pleasure as I consider that " Burmah-Shell " have not only shown marked foresight and enterprise in undertaking this work but have displayed considerable public spirit in casting their bread on the waters in the hope that it may be returned to them after many days. The experiments themselves have been conducted on a scale more extensive than has hitherto been the case in India, and what is perhaps quite as important, the results are of special value because of the accurate record of costs which has been maintained. A technical Sub-Committee of the Imperial Council of Agricultural Research examined the results and recommended their publication in the form of a monograph in view of their value to agriculturists throughout India.

I am aware that the agricultural depression through which the world is passing has produced doubts as to the value of wholesale mechanization in farming. It may also be argued that while the conditions for mechanized cultivation are ideal in countries like Canada, Australia, the United States, Argentina and present-day Russia, they are different in India which is largely a country of small holdings. On the other hand there are large areas in India suitable for mechanical cultivation and there is a definite future in India for tractors of a type adapted for Indian conditions. As a general-purpose tool, for the eradication of deep-rooted weeds, for the breaking up of new lands, and for other special purposes, the modern tractor has a value which we cannot afford to ignore. Co-operation in India, apart from credit, is still in its infancy, but when the co-operative principle is developed and extended to the sphere of agricultural production, there will be further scope for mechanization.

T. VIJAYARAGHAVACHARYA.

SIMLA,

*The 27th July, 1934.*

# INTRODUCTION.

This monograph on " Mechanical Cultivation " in India by the Burmah-Shell Company gives the history of what is probably the most extensive pioneer investigation into the costs of tractor cultivation, on a large scale, ever undertaken in India and describes the difficulties and obstacles which may be encountered in such a lengthy and extensive set of operations. It shows clearly what a large quantity of exceptionally valuable information with regard to tractors can be obtained by such continued investigation and the urgent necessity for further and continuous work on the same lines if India is ever to obtain conclusive data on this most important subject.

This investigation has had the all-important advantage of a fearless finance policy and although in course of perusal criticisms may be levelled at costs, points arise on which opinions may be divided and in some places theories appear to be advocated to which we cannot whole-heartedly subscribe, yet the fact remains that a very large amount of valuable information has been obtained by this work and India owes a deep debt of gratitude to the " Burmah-Shell " for their contribution to our knowledge on this subject, and the immense amount of time, expense and trouble which has been expended on this valuable piece of voluntary research.

We feel further that the publication of this work may possibly mark the turning point in the attitude of India towards such voluntary research and influenced by this example private enterprise may feel it a national duty to assist the Government in such work and thus come into line with other countries in this respect to the good of all concerned.

WYNNE SAYER.
D. P. JOHNSTON.
R. G. ALLAN.

*The Editorial Sub-committee of the Tractor Committee of the Imperial Council of Agricultural Research.*

# PREFACE.

In the preparation of this Monograph, we have received great assistance from various firms and gentlemen, and would particularly thank the following for their permission to reproduce extracts from reports, catalogues and photographs and other information :—

Messrs. Volkart Bros.
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„ William Jacks & Co.
Mr. Goslin of Messrs. Cockshutt Plough Co.
Mr. Pashabhai Patel.

We are also indebted to Mr. A Rowlison, Representative in India of the International Harvester Company, for reading through the draft chapters on tractors and ploughs and for certain valuable suggestions and criticisms. Very great assistance was also given by Dr. Burns, Director of Agriculture, Bombay, and Mr. Salimath, Deputy Director of Agriculture, Dharwar District, Bombay Presidency, in the compilation of statistics relating to the Dharwar Ploughing Project.

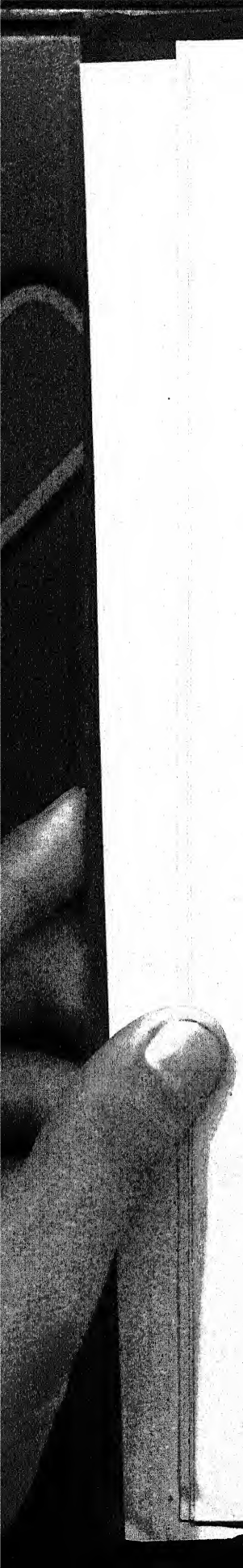
To Dewan Bahadur Sir T. Vijayaraghavacharya, K.B.E., Vice-Chairman of the Imperial Council of Agricultural Research, we also wish to express our grateful appreciation of the consideration shown to us throughout the period of our investigation covered by this monograph, and of his courtesy in inviting us to attend the annual meetings of the Advisory Council which greatly encouraged us in our work.

Finally, the help and assistance given by Mr. Burt, C.I.E., Agricultural Expert, and by the Sub-Committee appointed by the Imperial Council of Agricultural Research consisting of Messrs. Wynne Sayer, Allan and Johnston have been of incalculable value to us and we would express our sincere gratitude for the time they have devoted to the consideration of the draft manuscript.

E. MILLER,

BOMBAY,
*Dated the 25th January 1934.*

*General Manager in India, Development Department, Burmah-Shell Oil Storage and Distributing Co. of India, Ltd.*



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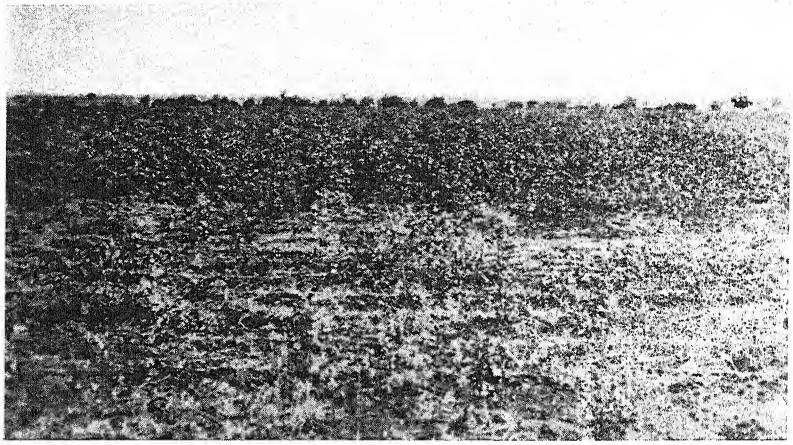

Savanur State.—Cotton on tractor ploughed land in background. Cotton on bullock ploughed land in foreground.

# MECHANICAL CULTIVATION IN INDIA.

## A history of the large scale experiments carried out by Burmah-Shell Oil Storage and Distributing Company of India, Ltd.

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(Received for publication on the 25th January 1934).

## CHAPTER I.

### AGRICULTURE IN INDIA—GENERAL.

The low standard of productivity from the land and the extremely poor standard of living of her land workers are both problems, the solutions of which are of extreme importance and urgency to India. The beginnings of agriculture were in the sub-tropical zones and these problems must be many thousands of years old going back to the days of the Moghuls and centuries before. A typical country scene with a man behind his little wooden plough and bullocks is similar to the many frescoes seen throughout Greece and Italy of the early cultivators at work in their fields. Agricultural India, despite the excellent efforts of the various Agricultural Departments, is in many ways centuries behind more advanced countries and is suffering as a result, economically and physically. Economically, inasmuch as a country of low yields and backward methods must inevitably be worse off than one which has adopted modern methods and has reaped the results of such methods—physically, because the soil is suffering from lack of manure, scientific attention and proper ploughing. Whilst the people also suffer physically because with such poor soil and low yields, their standard of living is considerably below that of many countries in the world. It was largely on these grounds and on grounds which are explained more fully later that Burmah-Shell decided to interest itself in agriculture and in the lot of the agriculturist more closely than it had done in the past, by investigating certain problems in connection with the cultivation of the land and the yield of the soil. It was felt that many important problems had not received from agricultural authorities and others in the past the attention which their importance justified, and that as a result agricultural India and her people were unnecessarily backward.

This monograph is intended to be a history of Burmah-Shell's efforts to assist in the agricultural development of India, and, before considering in any way facts and deeds, it is necessary to consider the various reasons which led the Company to take an interest in agriculture.

The first thing that occurs to the mind of the average man when he hears that a commercial undertaking is adopting some altruistic work is that there must be more in it than meets the eye and that there must be immediate profit to be gained by the Company. This is not always the case, and the undertaking in question is one of the exceptions.

The question of mechanisation had not received much attention in the past and as stated in the Report of the Royal Commission on Agriculture (1928), the main success of the Agricultural Departments has been in the direction of the introduction of improved varieties of crops. The question of the introduction of power was not however overlooked by the Linlithgow Commission and the following extracts from their report had some bearing on the decision to start the work of which detailed mention is made later.

"The use of large power machinery such as steam tackle and motor tractors is obviously naturally outside his (the small cultivator's) purview in the present conditions, and the only hope of placing it within his reach is by co-operative effort. It was held that a tractor would displace 8/10 pairs of bullocks and that in these circumstances the scope for the use of tractors in India was enormous. The Agricultural Departments do not appear at present* (1928) to be in a position to give a lead in regard to the use of steam tackle and motor tractors owing to the insufficiency of the investigations, which have so far been made into the economics of cultivation by their means. There appears, for example, reason to believe that the published figures of the cost of cultivation by steam tackle and tractors are sometimes misleading owing to the failure to include full allowance for interest on the capital cost of the plant and for depreciation. A thorough and business-like investigation of the economics of power cultivation appears to us to be specially called for in the Central Provinces where the use of such machinery seems to offer the only hope of bringing back to cultivation the extensive areas of land at present lying desolate owing to infestation with the deep-rooted *kans* grass. Whatever type of power machinery is found most suitable, a detailed investigation of the cost of employing it is essential."

The work to be described in this Monograph was largely undertaken in order to arrive at definite and reliable data regarding the suitability of present-day tractors and implements for work suitable for tractor ploughing and the cost thereof and the various schemes undertaken, which are dealt with later, have all been undertaken in the fullest co-operation with the Local Governments concerned and the Imperial Council of Agricultural Research.

* The Punjab Agricultural Department have during the past 12 years carried out tractor and steam tackle trials on their farms at Lyallpur.

India is an essentially agricultural country, over 80 per cent. of her population of 350 millions being engaged in agricultural pursuits, and, it is obvious that any improvement in agricultural conditions or in the living conditions of the millions earning their livelihood from the land must eventually be of benefit to every commercial undertaking in India, and particularly to an undertaking whose function it is to sell oil. Many people, when they first heard that Burmah-Shell were interesting themselves in agriculture, immediately took the narrow point of view and assumed that the Company was doing so because of the additional and immediate sales of oil that would result from an increase in the number of tractors employed. This was not the case and the Company took a far broader view and worked for the general development of the country. Any immediate increase in the sale of their products resulting from these activities will be infinitesimal as compared with the time and money spent on the various projects and this is fully realised by the Government and those in touch with their schemes. It is however hoped that along with other concerns Burmah-Shell will eventually benefit from the general development and progress that will result, but surely no one will grudge them this if their efforts prove successful.

## CHAPTER II.

## SCOPE FOR TRACTOR PLOUGHING.

### PART I. GENERAL—WEED ERADICATION.

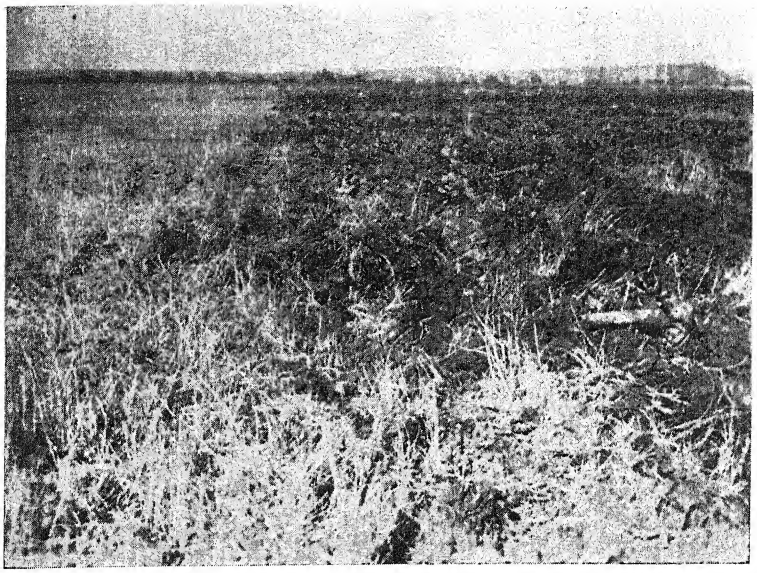
It is now proposed to deal with certain types of work which offer definite scope for introduction of mechanical methods of cultivation. The principal work and the one which is dealt with first, is in connection with the eradication of the deep-rooted weeds which are found throughout India such as *kans* (*Saccharum Spontaneum*), *hariali* (*Cynodon dactylon* Pl. I) and *kundah* (*Ischaemum pilosum*). The prospects of this type of work are practically unlimited. Though some investigations had been carried out with a view to ascertaining really effective means of eradicating *kans* near Jubbulpore in the Central Provinces and by Mr. Howard, Director of the Institute of Plant Industry at Indore for Malwa plateau conditions, the weed problem has never been really seriously tackled in India and deserves more attention than it has received up to date.

In America it is estimated that weeds cost the United States 300 million dollars annually, and if this figure can be relied upon, the loss to India must be even greater, because of land that is in consequence uncultivated or undeveloped. The chief evil effects of weed can be summarised as follows :—

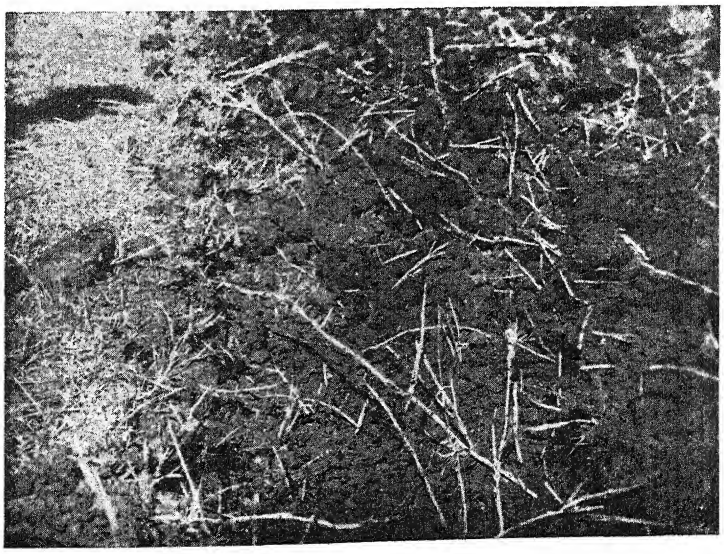
1. The yield is reduced.
2. The crop is damaged.
3. Profits are reduced.
4. The soil is robbed.
5. Land values are lowered.
6. In extreme cases land is left fallow.

Vast tracts of India are covered with weed and cannot be cultivated because ordinary bullock methods of cultivation are ineffective except for ploughing up to at most 6″—7″, whilst hand-digging is expensive, is restricted by the available labour and can only cover very small areas. Even in those cases where hand-digging is both economical and practical, tractor ploughing has certain advantages over hand-digging. In the latter case, the owner of the land has to neglect his other duties and supervise the large number of labourers employed on daily wages for a considerable period. With a tractor, no such supervision is necessary and his land will be ploughed in about 1/50th of the time taken by hand-digging.

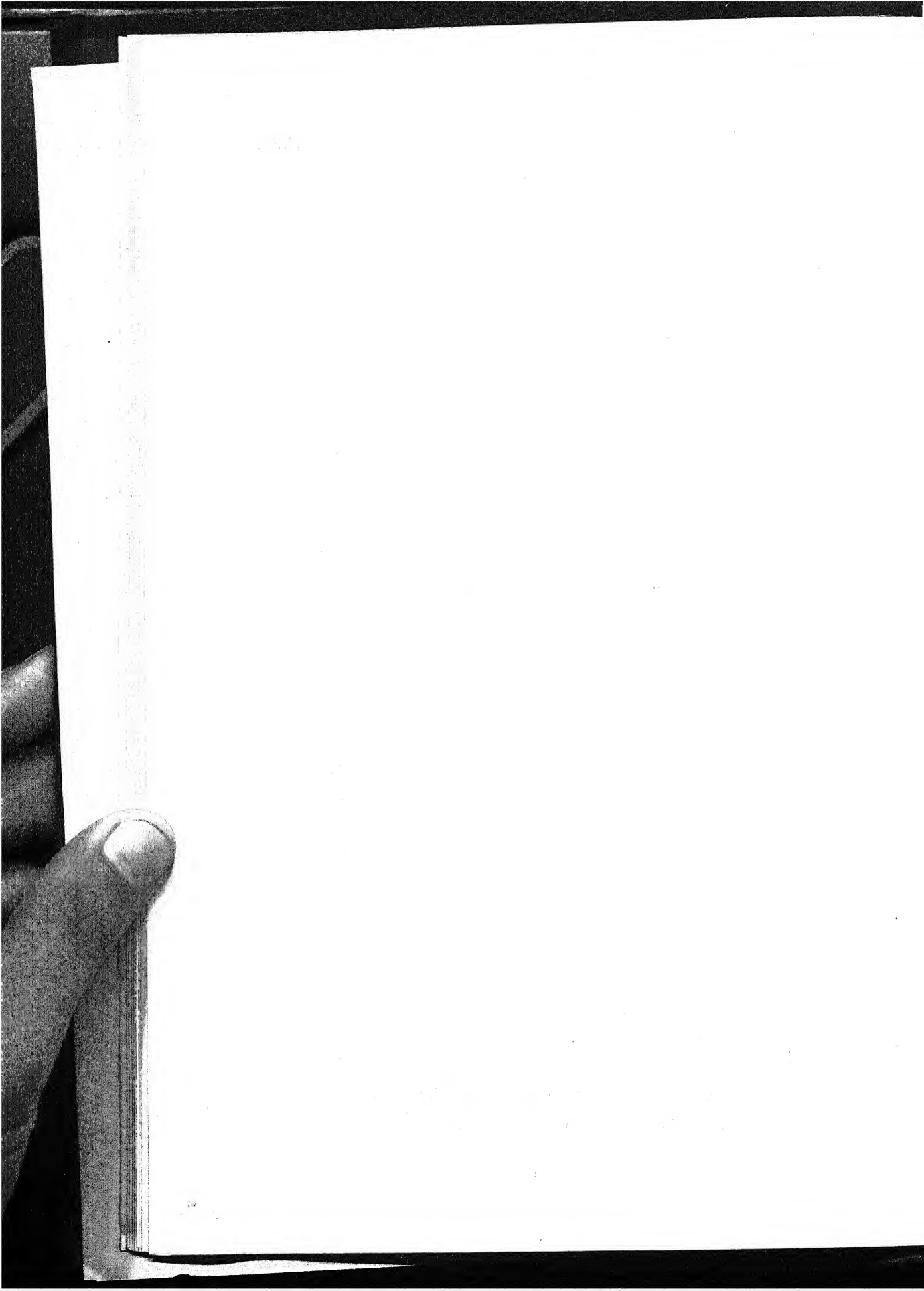
With hand-digging it is not usual for the whole field to be dug up, but only the weedy patches. The advantage gained by hand-digging is mainly limited to the removal of the grass, but during the eradication of weed by power, the whole field is ploughed and the soil is inverted, causing exposure to the sun and resulting in greater fertility.



1. *Hariali* infested ground (page 4.)



2. *Hariali* exposed to surface after ploughing (page 8).



Most agricultural authorities agree that crops in the year immediately following hand-digging of the weedy portions are poor in yield, whereas the exact opposite is the case with tractor ploughing, since the crops in the season following tractor ploughing give very good results as will be seen later. A good example of this is Mr. Narsingrao Nadgouda's lands at Mundergi near Gadag, in the Dharwar District of the Bombay Presidency. An area of 21 acres and 30 gunthas of this landlord's lands in the Muendi village was ploughed by tractor. Previous to tractor ploughing, this land did not yield sufficient to meet the Government assessment, but after tractor ploughing in 1931, at Rs. 15 per acre for 10″ work, cotton was sown and the crop was the best in the village, resulting in considerably increased revenue to Mr. Narsingrao Nadgouda, and consequent greater security and revenue to Government.

A statement of the crop yields and details of the re-growth of weed for certain of the land ploughed is given below ; this statement was prepared for the Director of Agriculture, Bombay, by the Deputy Director, Southern Division.

*Estimated yield in 1932-33 in fields ploughed with a tractor during 1931-32 at Meundi, Dharwar District.*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| Serial No. | Name of landlord. | Area ploughed (Acres and decimals of acres). | Name of crop. | Area under each crop. (Acres and decimals of acres). | Yield. Mds. | General remarks. | Percentage of re-growth of *hariali*. |
| 1 | Kallo Balagi Kulkarni . | 13·85 | Kumta Cotton. | 13·85 | 55 | Good | 10—11 |
| 2 | Ramkrishnabhat Saugar | 10·5 | Do. | 10·5 | 38 | Fair | 12—13 |
| 3 | Martandbhat Kavalur . | 17·15 | Do. | 17·15 | 48 | Do. | |
| 4 | Virupaxbhat Rajpurohit | 5·3 | Do. | 5·3 | 12 | Do. | 15 |
| 5 | Jaganathbhat Puranik | 16·125<br>16·775 | Do. | 32·9 | 90 | Do. | 15 |
| 6 | Narasing Rao Nadgouda | 5·2 | Do. | 5·2 | 10 | Do. | 12—15 |
| 7 | Bhimji Shriviwar . .<br>Bhimji S. Padki . . | 20·925<br>6·525 | Do.<br>Gram | 27·0<br>1·5 | 120<br>3 Bags. | Good | 10—12 |
| 7*a* | Not recorded . . | 22·05 | *Rala* Wheat and Safflower. | 5·0<br>16·0 | 6 Bags<br>10 *plus* 6 Bags. | Do.<br>Do. | |

*Estimated yield in 1932-33 in fields ploughed with a tractor during 1931-32 at Meundi, Dharwar District*—contd.

| 1 Serial No. | 2 Name of landlord. | 3 Area ploughed (Acres and decimals of acres). | 4 Name of crop. | 5 Area under each crop. (Acres and decimals of acres). | 6 Yield. | 7 General remarks. | 8 Percentage of re-growth of *hariali*. |
|---|---|---|---|---|---|---|---|
| 8 | Mallarbhat Joshi . . | 13·0 | Groundnut<br>*Kharif Jowar* and *Tur*. | 2·5<br>11·5 | 30 Bags<br>Not available. | Very good | 8—10 |
| 9 | Mallarbhat Joshi . . | 10·75<br>3·80 | Groundnut<br>*Kharif Jowar* and *Tur*. | 2·5<br>11·375 | 30 Bags<br>Not available. | Do. | 8—10 |

| | Rs. |
|---|---|
| *Groundnut*— | |
| Tractor ploughed lands yield per acre . . . . . 12 bags | 36 |
| Bullock ploughed lands yield per acre . . . . . 6 ,, | 18 |
| *Cotton*— | |
| Tractor ploughed lands yield per acre . . . . . 3½ mds. | |
| Bullock ploughed clean lands yield per acre . . . . . 1½ ,, | |
| Bullock ploughed *hariali* lands yield per acre . . . . . ¼ md. | |
| *Wheat*— | |
| Lands tractor ploughed for wheat were mixed with Safflower. | |
| Tractor ploughed lands yield per acre . . . . . 1 bag | |
| Bullock ploughed lands yield per acre . . . . . ⅘ ,, | |

*In unploughed lands.*

| Serial No. | Name of landlord. | Name of crop. | Area under crop. Acres. | Estimated yield. Mds. | Remarks. |
|---|---|---|---|---|---|
| 1 | Yellappa Bhawi Katti . | Kumpta Cotton. | 9 | 20 | 132 mds. in 89 acres. 1½ mds. per acre worth Rs. 3 per acre in normal soil. |
| | Tirakambhat Kashikar . | Do. | 48 | 50 | |
| 2 | Mahadevappa Meti . . | Do. | 22 | 32 | |
| 3 | Virupaxbhat Rajpurohit . | Do. | 9 | 10 | *Kari* (Alkaline) soil × 1·1/9th mds. in Kari soil worth Rs. 2-4-0 per acre. } Not average soil. |
| 4 | Sangappa Angadi . . | Do. | 15·225 | 5 | Ridden with Karki grass × ⅓ md. Worth Rs. 0-11-0 per acre. } Very bad but typical case of Karki. |
| 5 | Mallapa Alavandi . . | Do. | 10 | 30 | |
| | | | See Remarks. | | |
| 6 | Maharudrapa Alur . . | Wheat | 10 | 8 Bags | 4/5th bag per acre. Worth Rs. 6-6-0 per acre. |
| 7 | Yellappa Bhawi Katti . | *Rala* | 3 | 2 bags | 2/3rd bag per acre. Worth Rs. 3 per acre. |
| 8 | Ditto . . . | Groundnut | 5 | 30 bags | 6 bags per acre. Worth Rs. 18 per acre. |

*N.B.*— These figures were obtained by general inquiry, and not from actual crop tests, thus they are only indicative.
The crop valuation of the village in 1932-33 was only Re. 0-5-6 (Rev. Dept.), *i.e.*, 46 per cent. of normal.
The average assessment of lands in the village is only As. 12 per acre.

A further advantage of tractor-ploughing over hand-digging is that the former is considerably cheaper except in certain districts where labour is very cheap and plentiful.

The loss due to weed, not only to the owner of the land but to his tenant and to the country by the reduction of the value of the land and the failure or inability on the part of the land-owner to pay land revenue is enormous and, therefore, any step that is taken which enables weed to be eradicated in India is of inestimable advantage to the country. On the advice of the Imperial Council of Agricultural Research, the problem of weed eradication has received particular attention during the experimental work carried out by Burmah-Shell, and in the Chapters on the Dharwar and Raichur Ploughing Projects full details are given of the work carried out in these tracts, in the former of which the Deputy Director of Agriculture, Southern Division, Bombay Presidency, (Mr. Salimath) estimates there are 4,00,000 acres of weed infested land alone. Every year, Mr. Salimath says that more and more land goes out of cultivation in his division due to the growth of weed, and this is true of many other areas and especially of the North of the Central Provinces and the South of the United Provinces. The Acting Deputy Director of Agriculture, Northern Circle, Jubbulpore, Rao Sahib Pandit B. L. Dubey in a note on the subject says :—

"Within living memory *kans* had become established in the Saugor District after the famine of 1900 and by force of high prices it was fairly cleaned by 1926 when again a succession of bad seasons set in and *kans* made progress to an enormous extent as the Deputy Commissioner remarks. If conditions are allowed to take their own course and are not specially tackled, it is very likely that it will be long before we come to normal conditions.

I am also afraid that if *kans* is not specially tackled at once, the land which to-day is only foul of *kans* may in course of years fall fallow on account of the weed getting itself fully established."

In the Settlement Report of the Saugor District for the year 1911-16, Mr. (now Sir Geoffrey) Corbett said :—

"The climate is the cultivators' worst enemy. Next is the *kans* weed, which often follows a seasonal calamity and retards recovery."

In the three years 1921-22 to 1923-24 it is reported that 2,187,159 acres of land was "out of cultivation" in the ten districts comprising the two divisions of Jubbulpore and Nerbudda. A considerable proportion of this fallow area was occupied by *kans* grass, whilst the total area under cultivation at that time was 5,558,240 acres, *i.e.*, 39 per cent. of the total area was out of cultivation.

Even if land is not actually put out of cultivation, the growth of weed, owing to its hold in the soil and the easy manner in which it spreads, results in the value of the crops being reduced yearly and the economic condition of the land-owner

is thus weakened. As a result, during 1931, 1932 and 1933, of the depressed prices for agricultural crops landlords and cultivators have been less and less inclined or able to spend money on cultivating their land with an inevitable tendency for thousands of acres throughout India to go out of cultivation or to become foul with weed.

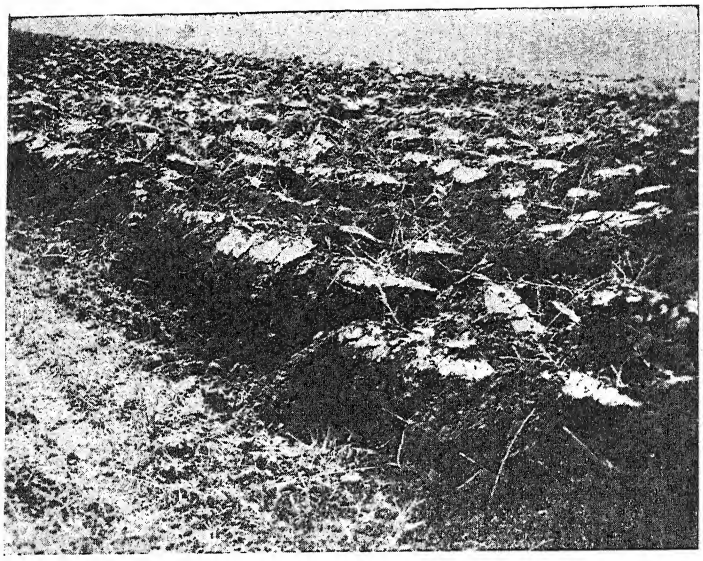
When it was decided to investigate the problem of tractor-ploughing for weed eradication, enquiries were made in the various Presidencies and Provinces and it was ascertained that in Bengal and the Punjab there was very little weed-infested area. The districts most affected with deep-seated weeds were found to be in the north of the Central Provinces on the western side of the Kosi river; in north Berar and in the north-eastern and northern parts of the Madras Presidency (including Hyderabad and Mysore States). To summarise the results of the enquiries, deep-seated weeds are found in large quantities, throughout Bombay Presidency and the Central Provinces and in parts of Madras and the United Provinces and in these areas constitute a very grave problem. The Hazro tract in the Campbellpur District in the Punjab is an exception and deep-seated weeds are also found in this portion of the Punjab.

The depth to which various weeds grow varies in different parts of India but an average depth of 10″/11″ can be taken, although in some cases ploughing up to 15″ and more is required and in others only up to 10″.

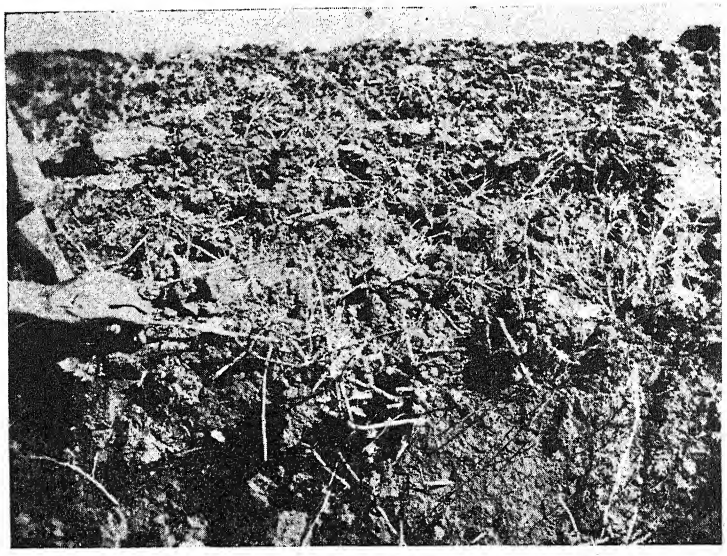
The depth of ploughing required depends upon the depth to which the mat of the rhizomes have penetrated as it is advisable to plough below the bottom of the mat if satisfactory and complete eradication is to be effected. From experience gained during seven years of tractor ploughing, Mr. Fletcher (Senior Ploughing Assistant, Burmah-Shell) is of the opinion that, unless the rhizomes are thoroughly ploughed out, re-growth will take place within three to four years. The depth of the bottom rhizomes, however, depends on the type of soil and the rainfall, so it is impossible to lay down any hard and fast rule which is applicable to all India, as the rhizomes penetrate from 6″ to 15″ (occasionally, deeper). As far as it is possible to generalise on the subject it can be said that in shallow black cotton soil areas, where the soil is shallow with a lime or moorum bed, the rhizomes do not penetrate below 9″, whereas in the poor red soils penetration above 6″ is rarely found. In light black cotton soil areas, which are usually found bordering red lands and black cotton soil belts, 9″ is the average depth. In medium black cotton soil sections, which receive a reasonable rainfall, the rhizomes generally work down from 9″ to 12″ and occasionally lower. In the deep black cotton soil tracts the rhizomes are found from 10″ to 12″ in the high land and down to 15″ in the low lands and waterways.

The Tractor Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research considered this matter at their meeting in August 1933, and it was agreed that for most types of deep-rooted grasses, it was sufficient to plough

PLATE II.



1. A field (*hariali* infested) ploughed 10″ deep (page 9).



2. *Hariali* (page 9).

just below the general mat of roots, so that these can be properly exposed to the sun when the furrows are well turned. The Committee considered that, for most purposes, 10″ ploughing or possibly less would be sufficient. The roots of *kans* grass on black soils run to several feet deep, so that complete eradication of the roots is out of the question.

Out of a mass of varying opinions on this subject, this is perhaps the most authoritative expression of opinion, since the Committee, whose decision this is, was composed of, among others, the Agricultural Expert to the Imperial Council of Agricultural Research, the Directors of Agriculture, Bombay, United Provinces, Punjab, Baroda State, Madras and Bihar and Orissa, and the Imperial Agriculturist at Pusa. Since inversion is usually necessary to successful eradication it is inadvisable to plough to a greater depth than actually required to eradicate the general mat. Deeper ploughing would not only involve unnecessary expenditure but might well result in the re-burying of the major portion of the rhizomes and also in undesirable sub-soils being brought to the surface. Careful inspection of the land to be ploughed is therefore essential before the depth is decided upon. It is also necessary to consider whether the extra expenditure incurred in deeper ploughing is justified by the probable increased crop yields. Deeper tillage, apart from being more expensive, also frequently results in the ploughed weed-roots, being ploughed in again and germinating if they had not dried out before the first rains. Tests carried out over a large area in Raichur District proved this and in tests carried out at Jubbulpore in 1921, it was found that it was not necessary to go to a greater depth than 8″ to kill the *kans*.

At the onset 12″ ploughing was undertaken, but at a later date it was found that 7″ to 8″ ploughing would kill *kans*, provided the soil was inverted to expose the underground stems to the sun and to smother the lower roots which still remained in the unploughed sub-soils, and provided also that ploughing was not done just before or during the rains. During the further experiments carried out by the Central Provinces Agricultural Department in 1923 at Jubbulpore in order to test whether the seed was viable, germination tests were carried out and results showing 95 per cent. germination were obtained. As mentioned already, *kans* invasion often follows a famine year and the reason for this is clear. During a famine year the crops are lost due to want of rain, whereas on the other hand the existing *kans* which has its roots deep down, survives. Since the soil is not cultivated, the *kans* seed is carried by the wind to neighbouring fields where it germinates.

The average depth of 10″/11″ required under some conditions is considerably greater than the depth of ploughing required in other countries and this, therefore, means that many ploughs which have been found eminently suitable in America, Europe and other countries are unsuitable for Indian conditions.

It is often essential to obtain complete inversion when tractor ploughing for *kans* eradication, as unless the weed is completely killed by the action of the sun

it will regerminate, and the question of obtaining the most satisfactory and complete inversion is of the greatest importance. The most suitable types of implements for deep ploughing in order to obtain full inversion are discussed in Chapter VIII. Broadly speaking, the roots of the weed are exposed to the sun by the use of Mouldboard ploughs, which invert the soil and the roots are dried off during the hot months. Deep ploughing for weed eradication during the rains or for a short period before the rains is, therefore, inadvisable.

It has already been stated that deep ploughing for eradicating the deep seated weeds means better cultivation and it is necessary, therefore, to consider the results obtained as a result of the deep ploughing for weed eradication carried out in the Raichur District from 1930 to 1933 and in the Dharwar District during the same period. In a report on this subject Mr. Gundappa S. Kurpad, Deputy Director of Agriculture, Karnatak Division, Raichur, H. E. H. the Nizam's Agricultural Department, reports that he visited in April 1933 some of the fields near Gonal, which had been tractor ploughed in 1932. Some of these fields were full of *kundah* and *hariali* grasses prior to tractor ploughing and he found on his inspection in 1933 that they were looking very well with a good crop on them. Mr. Kurpad in his report continues :—

> " Where the fields have received good cultivation before the present crop was put in and after *more than 80 per cent. of the land is free of all weeds.* Where the cultivation has not been so thorough weeds have appeared here and there. This is so especially in the rows of plants where no cultivation has been done. The land between the rows is fairly clear of weeds and in the rows we find grass. This seems to be a fairly clear indication of the value of cultivation after tractoring.
>
> In certain portions of the lands, patches of grass are visible. This is perhaps due to the fact that in those places, the roots of the grass have gone deeper. Within a fortnight of the tractor operations, during the latter part of (Ardibehest 1341 F.) March 1932 it rained and this must have helped the grass to grow to the surface so soon.
>
> Again, long narrow patches of grass are visible in certain fields. These are evidently due to leaving unploughed land or dead furrows in the middle of the field. Such strips are more in some fields than in others and are evidently due to bad ploughing."

This unprejudiced official report from an Agricultural Expert is sufficient to show in a convincing manner the value of tractor ploughing for weed eradication. The necessity to leave unploughed land in the form of back or dead furrows is often unavoidable and those portions which form a negligible fraction of the whole can be cultivated by hand after tractor-ploughing is finished.

The dead furrows referred to in Mr. Kurpad's report are not entirely due to bad ploughing, as there must be certain furrows which occur when the land is opened up for ploughing which cannot be economically tractor-ploughed. Dead furrows can, however, be avoided to a large extent by the correct lay-out of the work and it will usually be more economical to have such portions ploughed by bullocks or hand-dug rather than tractor-ploughed.

The Deputy Director of Agriculture, Southern Division, Bombay Presidency, reported that a high percentage of weed eradication had been obtained on tractor ploughed lands and the crop yields had increased by 100 per cent. and more over yields from bullock-ploughed lands. Full details of results in the Dharwar District are given in Chapter III.

## Part II. Power Farming—Co-operative Effort—Contract Work.

The use of tractors for deep ploughing in weed infested areas is naturally limited by the period in which ploughing can be carried out, which is generally speaking from December to April, although in certain parts of the country ploughing can be started at the end of October or early in November and continued into May. As a general rule ploughing for weed eradication should not be carried out within a fortnight of the start or cessation of the rains in order to enable the soil and the exposed roots to dry thoroughly before work. As a tractor should be used at least nine months in a year in order to employ it economically, the scope for tractors will be considerably enlarged if they can be employed for a greater portion of the year on various farm operations, such as ploughing, harrowing, sowing, interculturing and for belt work. There is no difficulty for the bigger landlords to do this and there is also no reason why smaller landlords should not join together and buy tractors for all of their agricultural operations. In any districts where bullocks are scarce, such as Sind, and certain areas of Hyderabad State, the advantages of power farming are obvious, but in those districts where bullocks are plentiful the question of the utilization of surplus bullocks forms a separate problem.

With the introduction of power, the number of bullocks employed on large farms can, however, be reduced, and the consequent heavy expenditure on bullocks will, therefore, be decreased. As a result the standard of cattle stock should improve, as the fewer the cattle required, more attention can be paid to feeding. The introduction of tractors for farm work should eventually, therefore, improve the stock of cattle in India. In addition, mechanical power will relieve the strain on bullocks at times of heavy work. For example, if mechanical power is introduced to drive and transport a threshing machine, the standard of cultivation could be improved by the release of bullocks for the early preparation of land for the coming monsoon crops, and also by the release of labour for such operations as hauling sugarcane.

India being a country of small holdings the scope for the use of tractors by individuals must of necessity be limited, although there is a large number of big landlords and cultivators whose holdings are large enough to justify the use of tractors. An area of 200 acres can justify one tractor provided all operations are mechanised. It is necessary, therefore, for the smaller holders to group together and purchase and work tractors on a co-operative basis, or alternatively to put out their lands to be tractor ploughed and cultivated on contract. The scope for tractor ploughing in India, irrespective of what type of work is to be done, can be summarised as lying along the following three avenues :—

1. Individuals.
2. Co-operative effort.
3. Contract.

### Co-operative effort.

An enormous possibility of co-operative development in India was vividly visualised by His Majesty the King-Emperor, who in 1911 at the Durbar in Delhi declared that :—

> " If the system of co-operation can be introduced and utilised to the full, I foresee a great and glorious future for the agricultural interests of the country."

Unfortunately there has been little progress made other than in the direction of credit, although this need cause no great surprise since indebtedness and its relief is the chief problem in India. Sir Horace Plunket*—the Doyen of co-operation—says " co-operation must be an integral part of a progressive agricultural policy and in this policy co-operative farming by modern methods must play its important part ".

It has already been remarked that so far in India there has been no general movement to form co-operative association for the co-ordination of labour and means of production, and, whilst the subject of co-operation generally is of such enormous interest and importance to India, it is outside the scope of this monograph to mention forms of co-operation, other than those connected with the cultivation of land.

When considering modern methods of cultivation, and especially work in connection with weed eradication, Co-operative Cultivation Societies are of great importance.

It is a much worn statement that in India small holdings predominate making tractor-ploughing by an individual in many cases impossible, even though he may wish to have his land tractor-ploughed and may wish to reap the advantages of modern methods of cultivation. If co-operative societies for labour and means of-

* Introduction to " The Co-operative Movement in India " by Miss Eleanor M. Hough—P. S. King & Son, Ltd.

production are formed, mechanical cultivation can be more easily adopted on a scale at present impossible. Each group or society will have its own tractor or tractors which will plough and cultivate the land of each number of that group, with the result that land now unable to be cultivated will be brought under cultivation, crop yields will improve, and the number of bullocks required will be decreased with a consequent reduction in the national fodder expenditure. In any such organization, whilst certain implements will be the joint property of all members of the group or society, each individual will retain his ownership and rights in his own property, and the produce from which will be the owner's complete and individual property.

It is only along these lines that it will be possible for a very large percentage of Indian agriculturists to adopt modern methods of cultivation and to reap the many advantages therefrom. All the work for the members of the group can be carried out by a tractor or tractors, which in addition can be utilised for marketing work, for belt work, and even for providing power for electric light undertakings for villages in the group. Cultivation by co-operative societies will, therefore, not only have its reactions on the produce of the land, but on the life and well-being of its members.

## Contract Work.

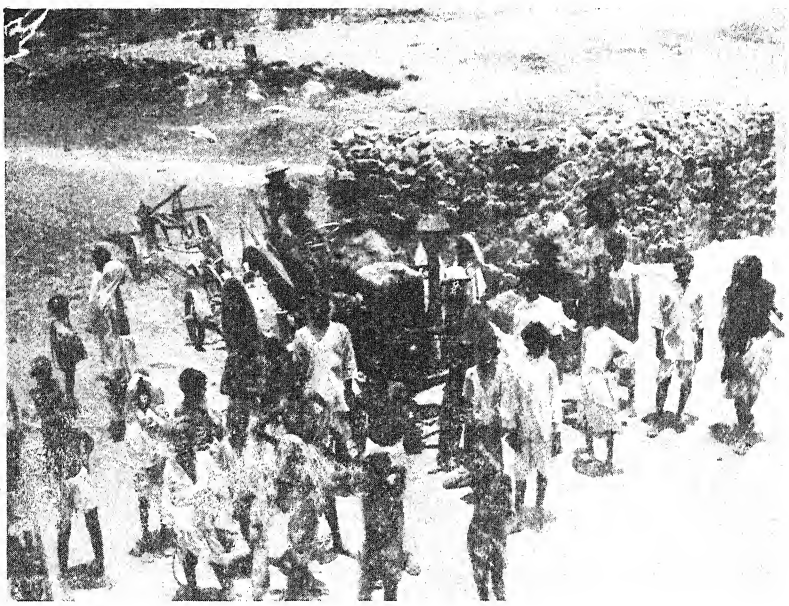
There is probably no country in the world in which mechanical farming on a contract basis offers so large and ready a field for commercial enterprise as India. The smallness of the average holding and the conservatism of the average Indian are the factors which work in favour of contract work against individual ownership. So far there have been few individuals or firms in India willing to take the first step but the experience gained during the experiments described in this monograph should encourage contractors to start work. There is a very large demand for tractor ploughing in India on a contract basis and thousands of acres can be obtained in various parts of India at profitable rates, which should give a return of 15 per cent. on capital, after allowing fully for depreciation, interest and supervision charges. The subject is one of such interest that a separate chapter (Chapter IX—Organization of Contract Tractor Ploughing) is devoted to this subject. Any firm or individual taking up this work will have the additional satisfaction of knowing that it is work which is of vast vital importance to India and to its huge agricultural population.

## CHAPTER III.

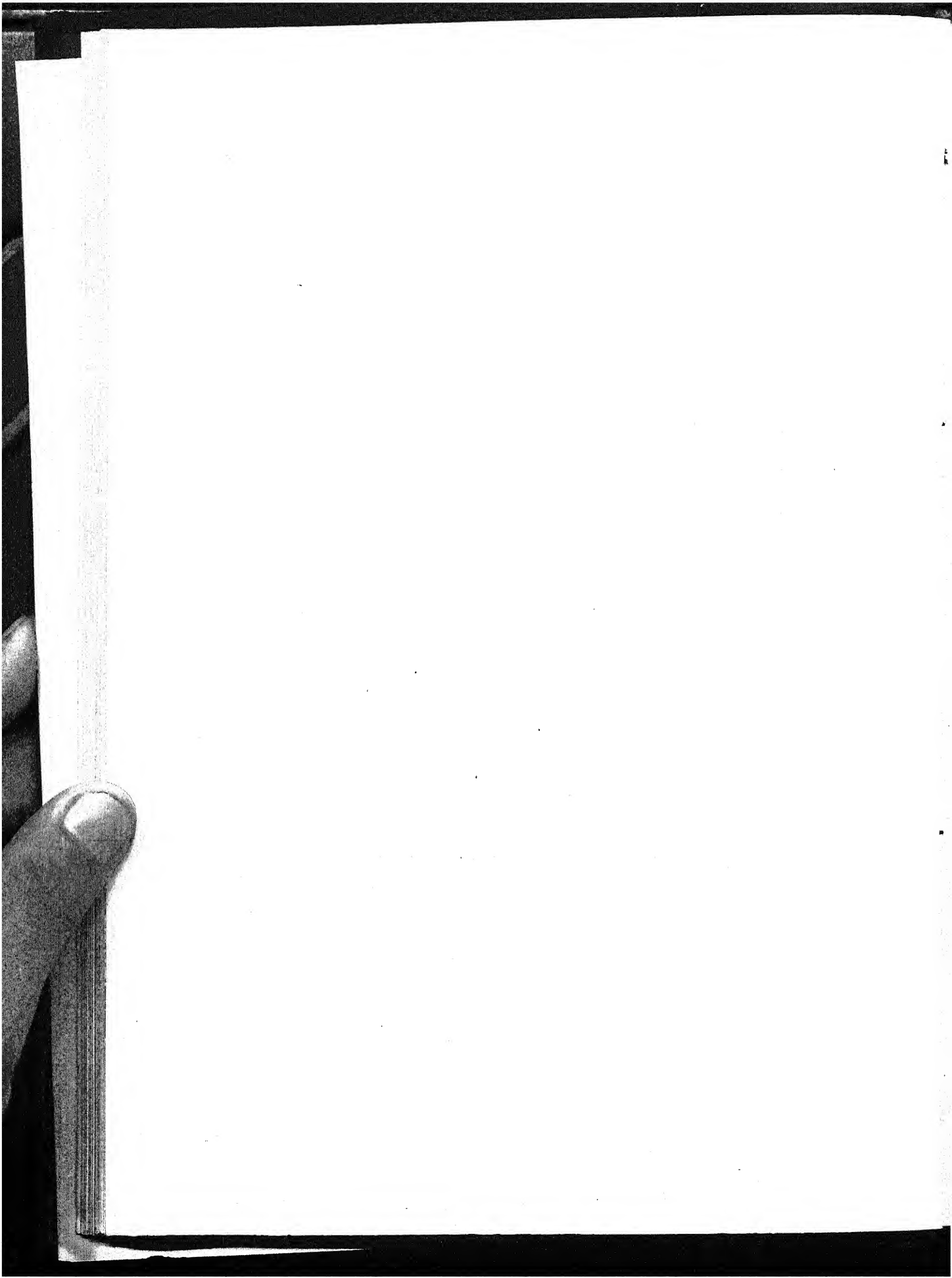
## DHARWAR PLOUGHING PROJECT.

The Dharwar District lies in the southern portion of the Bombay Presidency and is situated in what is known as the Bombay Karnatak. This district was selected by the Director of Agriculture, Bombay Presidency, as one in which there was a very large area of weed-infested land, and when the experimental tractor work was first started, it was recommended that experiments be carried out in selected areas of the district. The main objects of the experiments carried out in the Dharwar District were to determine suitable types of tractors and of ploughs for the eradication of a deep-rooted grass found throughout that portion of the Presidency and also to ascertain the costs and economics of these operations. The grass found in the Dharwar District is *hariali* (*Cynodon dactylon*), a grass which spreads very fast in cultivated fields through its runners and which penetrates to different depths according to the nature of the soil and the amount of rainfall. It was found that ordinary cultivating operations such as shallow ploughing, harrowing, interculturing and weeding do not result in the destruction of the weed, and whilst hand-digging is a remedy, this operation is both slow and expensive and cannot deal with the increasing growth of *hariali*. The eradication of this weed was, therefore, a considerable problem both to the agricultural authorities and to the cultivators, since the yield of land affected with *hariali* was consistently decreasing and many fields were going out of cultivation. *Hariali* is a pest not only in the Bombay Presidency, but also in many other parts of India, such as in portions of the Madras Presidency, in H. E. H. the Nizam's Dominions and the Mysore State. The Deputy Director of Agriculture, Southern Division (Mr. S. S. Salimath), under whose jurisdiction the Dharwar District comes, estimated that about twenty per cent. of the black cotton soil area was affected with *hariali*, which represents 800,000 acres, and he stated that if this weed were removed, the yield of cultivated crops would be at least doubled. Assuming, at a conservative estimate, that the value of the increased produce would be Rs. 10 per acre, the benefits to the cultivators would be very large, the individual income of the ryot would be increased and the benefits to the Government would also be considerable, inasmuch as the land revenue would be easier to obtain.

For the greater portion of the three seasons in which work was carried out in this district, ploughing was confined to a depth of 10″ in red soils and in light and medium and black cotton soils, and to experimental work in connection with suitable plough designs for ploughing below 10″ in the heavy black cotton soil. Except in the heavy black cotton soil areas, it was sufficient to plough down to 10″ in order to obtain a high percentage of weed eradication. The following summary (prepared



The first arrival of a tractor in Meundi village, Dharwar District (page 14).



by the Bombay Department of Agriculture) of the depth at which the weed was found in the various plough pits dug by the Government canvassers supports this statement.

*Summarised analysis of observations of trial pits showing the depth of "hariali" taken in the area canvassed during 1932-33.*

| Name of the centre. | Name of the village. | No. of tests to different depths. | | | | | |
|---|---|---|---|---|---|---|---|
| | | 9″ | 10″ | 11″ | 12″ | 13″ | 14″ |
| Huilgol | Huilgol | 4 | 10 | 38 | 29 | 2 | 1 |
| | Beladhadi | 11 | 24 | 44 | 25 | .. | 1 |
| | Nabhapur | 2 | 7 | 13 | 6 | .. | 1 |
| | Kalsapur | .. | 2 | 1 | 5 | 1 | .. |
| Nargund | Nargund | 23 | 22 | 8 | .. | .. | .. |
| Meundi | Meundi | 36 | 64 | 5 | 2 | .. | .. |
| | Shirur | 7 | 25 | .. | .. | .. | .. |
| | Haitapur. | 13 | 28 | .. | .. | .. | .. |
| | Kadampur | 5 | 6 | .. | .. | .. | .. |

"In Huilgol centre, the soil is mostly deep black and *hariali* in most places has penetrated the soil to a depth of 11″ and 12″. In Meundi centre, the soil is lighter and the depth of *hariali* is a little less. Here too, the cultivators feel that it is safer to plough to a depth of 12″ except in red and reddish soils, where *hariali* does not exceed 9″." (Comments made by Deputy Director of Agriculture.)

In the heavy black cotton soil areas, weeds grow deeper and the work is naturally heavier—demanding a stronger and special type of plough and a powerful type of tractor to pull it; the question of ploughing deep black cotton soil is dealt with later.

The real test of the success of the work can only be obtained by watching the re-growth of the grass in the ploughed areas and by comparing the crop yields with those in hand-dug and bullock-ploughed areas.

The following statements (also prepared by the Deputy Director of Agriculture, Southern Division, Dharwar, for the Director of Agriculture, Bombay) show the re-growth of weed in tractor-ploughed fields during 1931-32 and 1932-33.

*Grades used to mark the degree of re-growth of "hariali."*

| Grades. | Percentage of the field affected. |
|---|---|
| I | Up to 10 per cent. re-growth. |
| II | From 11 to 20 per cent. re-growth. |
| III | From 21 to 30 per cent. re-growth. |
| IV | From 31 to 40 per cent. re-growth. |
| V | From 41 to 50 per cent. re-growth. |
| VI | Above 50 per cent. re-growth. |

*Summarised analysis of observations on the re-growth of "hariali" at Maradigi centre.*

(10″ Section.)

| Original stand. | | Re-growth. | | | | | |
|---|---|---|---|---|---|---|---|
| Grades. | Acres. | I. | II. | III. | IV. | V. | VI. |
| I . . . | .. | .. | .. | .. | .. | .. | .. |
| II . . . | .. | .. | .. | .. | .. | .. | .. |
| III . . . | .. | .. | .. | .. | .. | .. | .. |
| IV . . . | 7 | .. | 7 | .. | .. | .. | .. |
| V . . . | .. | .. | .. | .. | .. | .. | .. |
| VI . . . | 208 | .. | 7 | 8 | 50 | 39 | 104 |
| (12″ Section.) | | | | | | | |
| VI . . . | 7 | .. | 7 | .. | .. | .. | .. |

*Inferences.*

(By Deputy Director of Agriculture, Southern Division, Bombay.)

"About 50 per cent. of the lands ploughed have remained as they were and the cultivators are dissatisfied with the work done there. The owners of other lands, where the extent of *hariali* is reduced, have realised some benefit, but not to the fullest extent. Wheat and cotton were the important crops grown in the first year after ploughing. Wheat suffered from rust and yields of cotton were also below normal. In the second year after ploughing also the season was unfavourable and the yields of crops grown were below normal. It is very difficult to estimate accurately the benefits derived from increased yields in tractor-ploughed fields, but taking the value of the average yield of wheat and cotton together for the first year as Rs. 6 per acre in the lands with *hariali* under stage VI, the value of yield of crops in lands under stage V may be taken as Rs. 7 per acre, that under IV as Rs. 8, under III as Rs. 10 and under II as Rs. 12. I consider that tractor ploughing has benefited at Maradigi to a certain extent only the owners of 22 acres which have passed from Stage VI to Stages II and III. It has not been advantageous to others."

*Summarised analysis of observations on the re-growth of hariali at Shiggaon centre.*

(12″ Section.)

| Original stand. | | Re-growth. | | | | | |
|---|---|---|---|---|---|---|---|
| Grades. | Acres. | I. | II. | III. | IV. | V. | VI. |
| I . . . | .. | .. | .. | .. | .. | .. | .. |
| II . . . | .. | .. | .. | .. | .. | .. | .. |
| III . . . | .. | .. | .. | .. | .. | .. | .. |
| IV . . . | .. | .. | .. | .. | .. | .. | .. |
| V . . | .. | .. | .. | .. | .. | .. | .. |
| VI . . . | 177 | 11 | 54 | 41 | 16 | .. | 54 |

(10″ Section.)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| VI . . . | 62 | .. | 43 | .. | .. | .. | 19 |

*Inferences.*

(By the Deputy Director of Agriculture, Southern Division, Bombay.)

" Out of 177 acres ploughed to 12″ depth, *hariali* in 54 acres has remained as it was and the work, therefore, has not been approved by the cultivators. The work done to 10″ depth is more satisfactory. The scope for 10″ ploughing in Shiggaon centre, however, is very limited, as the soil is black in general and the depth of *hariali* is more than 10″. Only one crop was taken after ploughing in Shiggaon centre and it was principally cotton. The season was unfavourable and the yields of cotton were below normal for the tract. The average yield of cotton in the land with *hariali* under Stage VI is 3 maunds per acre valued at Rs. 7-8-0, and under IV and III 5 maunds valued at Rs. 12-8-0. From this it will be seen that the owners of 149 acres which have passed from Stage VI to Stage II or III have obtained fairly good benefits. In more favourable seasons they are likely to get more."

*Summarised analysis of observations on the re-growth of hariali at Meundi centre.*

(12″ Section.)

| Original stand. | | Re-growth. | | | | | |
|---|---|---|---|---|---|---|---|
| Grades. | Acres. | I. | II. | III. | IV. | V. | VI. |
| I . . . | .. | .. | .. | .. | .. | .. | .. |
| II . . . | .. | .. | .. | .. | .. | .. | .. |
| III . . . | .. | .. | .. | .. | .. | .. | .. |
| IV . . . | 8 | 8 | .. | .. | .. | .. | .. |
| V . . . | .. | .. | .. | .. | .. | .. | .. |
| VI . . . | 263 | 79 | 130 | 8 | .. | 16 | 30 |
| (10″ Section.) | | | | | | | |
| VI . . . | 83 | .. | 74 | 9 | .. | .. | .. |

*Inferences.*

(By the Deputy Director of Agriculture, Southern Division, Bombay.)

"Most of the land ploughed has passed from Stage VI to Stage II, and the cultivators are more or less satisfied with the work done in Meundi centre. This is mainly due to the fact that the land ploughed is lighter and the depth of *hariali* less than in deep black cotton soil. Only one crop was taken after ploughing in Meundi centre and cotton was the principal one. The season was unfavourable and the yields obtained were low. The average yield of cotton in the land with *hariali* under Stage VI is 1 maund per acre valued at about Rs. 2-8-0, and that in Stage II, 2½ maunds per acre valued at Rs. 5. The value of extra yield, Rs. 2-8-0 per acre, is, no doubt, too small this year to cover the expenses of ploughing, but the

yields are expected to be better in the ploughed lands under more favourable seasons. I must make it clear, however, here that Meundi centre is subject to scarcity and good seasons are few in number."

Tractor ploughing in the Meundi area was mostly done on waste land, whilst that at Maradgi was carried out in cultivated land where the results were not so satisfactory. The reason for this is that the Maradgi work during the first season was carried out when there was very little practical experience available and the work was definitely experimental, resulting in a certain amount of faulty ploughing. In a report on this subject Mr. Salimath said :—

> "Apart from the re-growth of *hariali*, the tractor ploughing has increased the yields of cotton and *jowar* in both cases. This increase is the combined result of the two factors of tractor ploughing, *viz.*, (1) removal of *hariali*, (2) deeper tillage."

It will be seen, therefore, that the work carried out in all soils, except the heavy black cotton soil, resulted in a high percentage of weed eradication and largely increased the crop yields. There would appear, therefore, to be no need to plough to a greater depth than 10" in *hariali*-infested land when the soil is light, medium or heavy red soil, or light or medium black cotton soil. While it is admitted that deeper ploughing might possibly result in an even higher percentage of weed eradication, it is very doubtful whether the further increase in crop yield which would result would justify the extra expenditure incurred by ploughing deeper than 10".

*1930-33 Seasons.*—During the three seasons' work in the Dharwar District the following tractors were employed :

| Tractor. | Season. |
|---|---|
| 13 H. P .Mercedes Benz . . . | 1930-31. |
| 30 H. P. Caterpillar . . . . | 1930-31 and 1931-32. |
| 22-36 McCormick-Deering . . . | 1932-33. |
| 15-30 McCormick-Deering . . . | 1932-33. |
| 15-30 Lanz (Two) . . . . | 1931-32 (portion only). |

In all 1,105 acres were ploughed in 3,622 ploughing hours, giving an average of ·305 acre per hour, one acre being ploughed in 3 hrs. 17 m. The actual ploughing time represents approximately 50 per cent. of the total possible ploughing time, based on a 16-hour day, much time being lost due to delays in the grant of *takavi*, rains, land not being ready for ploughing, break-downs and lack of spare parts. The following are summaries of fuel consumption and costs and of expenditure on spare parts and other main items for each season and for the combined seasons.

## *Summary of costs (other than fuel).*

*(In Rupees, annas and pies.)*

| Tractor. | Season. | Area ploughed. Acres. | Tractor spares. | | Plough spares. | | Drivers. | | Transit. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| *Caterpillar 30 H. P. | 1930-31 | 137·45 | 0 1 6 | 0 0 8 | 0 1 2 | 0 0 6 | 2 1 2 | 0 14 11 | 0 5 10 | 0 2 8 |
| | 1931-32 | 304·23 | 1 10 2 | 0 7 10 | 0 10 8 | 0 3 2 | 3 1 10 | 0 15 2 | 1 3 3 | 0 5 9 |
| †Mercedes Benz | 1930-31 | 279·25 | 0 11 7 | 0 4 2 | 0 11 2 | 0 4 1 | 2 10 11 | 0 15 7 | 0 2 7 | 0 0 11 |
| ‡McCormick-Deering 15-30 | 1931-32 | 117·14 | 1 2 0 | 0 3 2 | 1 12 3 | 0 5 0 | 5 0 6 | 0 14 3 | 2 2 2 | 0 6 1 |
| | 1932-33 | 32·75 | 2 11 0 | 0 11 9 | 1 0 9 | 0 4 7 | 4 14 3 | 1 5 9 | 0 7 4 | 0 2 0 |
| §McCormick-Deering 22-36 | 1932-33 | 100·00 | 0 6 0 | 0 1 5 | 0 15 4 | 0 3 7 | 2 12 11 | 0 10 5 | 0 13 3 | 0 1 11 |

## *Fuel costs.*

*(In Rupees, annas and pies.)*

| Tractor. | Season. | Area ploughed. Acres. | Petrol. | | Fuel. | | Lubricating oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per hour. | Per acre. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| Caterpillar 30 H. P. | 1930-31 | 137·45 | .. | .. | 4 9 0 | 2 5 2 | 0 7 7 | 0 3 7 | 0 1 7 | 0 0 9 |
| | 1931-32 | 304·23 | 1 0 6 | 0 6 0 | 4 10 0 | 1 8 4 | 0 14 10 | 0 5 8 | 0 2 5 | 0 0 11 |
| | | | *Kerosene.* | | *Fuel Oil.* | | | | | |
| Mercedes Benz (Fuel Oil) | 1930-31 | 279·25 | .. | .. | 1 3 8 | 0 7 7 | 0 10 2 | 0 3 10 | 0 2 3 | 0 0 10 |
| | | | *Petrol.* | | *Kerosene.* | | | | | |
| McCormick-Deering 15-30 | 1931-32 | 117·14 | 0 12 0 | 0 3 2 | 3 11 0 | 1 8 4 | 0 9 6 | 0 2 5 | 0 3 2 | 0 0 9 |
| | 1932-33 | 32·75 | 0 5 9 | 0 1 9 | 4 12 3 | 1 5 9 | 0 11 4 | 0 3 6 | 0 1 2 | 0 0 5 |
| McCormick-Deering 22-36 | 1932-33 | 100·00 | 0 7 2 | 0 1 10 | 5 0 3 | 1 5 1 | 0 6 9 | 0 1 7 | 0 2 8 | 0 0 7 |

*1. No. 8 P. & O. 2-Furrow plough used.
3-Furrow P. & O. plough used.
4-Furrow International Disc plough used.
†2. 3-Furrow P. & O. plough used.
‡3. Ransome 2-Furrow mouldboard plough used.
§4. 2-Furrow Ransomes plough used.

## *Fuel consumption.*

(*In gallons per acre and per hour.*)

| Tractor. | Season. | Area ploughed. Acres. | Petrol. | | Fuel. | | Lubricating oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| Caterpillar 30 H. P. . . . | 1930-31 | 137·45 | .. | .. | 5·288 | 2·483 | ·237 | ·111 | ·265 | ·125 |
| | 1931-32 | 304·23 | ·675 | ·245 | 6·782 | 2·232 | ·521 | ·194 | ·413 | ·168 |
| | | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Mercedes Benz (Fuel oil) . . . | 1930-31 | 279·25 | .. | .. | 2·790 | 1·052 | ·224 | ·085 | ·180 | ·068 |
| | | | *Petrol.* | | *Kerosene.* | | | | | |
| McCormick-Deering 15-30 . | 1931-32 | 117·14 | ·489 | ·130 | 12·763 | 2·519 | ·412 | ·111 | ·550 | ·135 |
| | 1932-33 | 32·75 | ·224 | ·067 | 8·167 | 2·330 | ·465 | ·150 | ·213 | ·077 |
| McCormick-Deering 22-36 . . | 1932-33 | 100·00 | ·288 | ·071 | 8·62 | 2·261 | ·27 | ·063 | ·48 | ·111 |

The hours worked and spare part expenditure for each tractor were as follows :— (The figures for the two Lanz tractors are given under the Raichur Project).

| Tractor. | Season. | Ploughing hours. | Spare part expenditure. |
|---|---|---|---|
| | | H. M. | Rs. A P. |
| Caterpillar | 1930-31 | 280 15 | 22 14 0* |
| | 1931-32 | 884 00 | 18 10 9 |
| | | 1,164 15 | 41 8 9 |
| Mercedes Benz | 1930-31 | 715 00 | 394 7 0† |
| McCormick-Deering 15-30 | 1931-32 | 155 30 | 37 0 0 |
| | 1932-33 | 402 15 | 314 7 8‡ |
| McCormick-Deering 22-36 | 1932-33 | 361 00 | 37 6 9 |

* Spares for tractor and plough.

† Spare part expenditure high as tractor imported for test—no manufacturer's spares available—locally made parts proved unsuccessful necessitating numerous renewals.

‡ This tractor having been in commission since 1926, the heavy expenditure incurred is not excessive in view of its previous work.

## CHAPTER IV.

## RAICHUR PLOUGHING PROJECT.

The Raichur District is situated in the south-eastern portion of H. E. H. the Nizam's Dominions. About two-thirds of the boundary of the district adjoins British territory and the remainder, to the north, adjoins the State districts of Gulburga and Mahboobnagar. Raichur is one of the three frontier districts of the State, and according to Mr. S. Keshava Iyengar, who carried out an economic investigation in Hyderabad State in 1929-30, it stands first with regard to general, social and economic touch with neighbouring British Indian Districts. The District is a long narrow strip running west to east, and Raichur is the District Headquarters. Of the various Talukas in the district, Alampur belongs, by soil and rainfall as well as by population and social conditions, to the Telangana tract and ranks first in fertility and popular welfare. Raichur and the northern Talukas come next, while Manvi, Sindhanur and Gangavathi suffer intensively on account of severe and continuous failure of water supply for man and cattle, let alone agriculture. This feature is most important in regard to tractor ploughing, as, there is also a shortage of cattle and the difficulties of cultivation are therefore greater than those experienced in other parts of the State and India in general. Generally speaking, the land in Raichur District is not in the hands of the few (if Alampur Taluka is excepted). Mr. Iyengar* surveyed ten villages as representative of the interior and two as having road facilities. In four of these twelve villages, the average size of the holding of dry land is 17 acres 17 gunthas, of wet land 32 gunthas and of garden land 32 gunthas also. The actual number of occupants of the land is 990, of which nine only hold wet land and two garden land. Of the 990 landlords, 107 are non-cultivators and 883 are cultivating occupants. Four of the 107 non-cultivators are *sowkars*, three merchants, four village officers, forty-five engaged in other occupations and fifty-one are rent-receivers.

Some decades ago there was tank irrigation, but the failure of rain for the past two decades has made wet cultivation a thing of the past.

*Jowar* (*Sorghum*), cotton and ground-nut are the chief crops of this district.

Generally speaking, the district is not well provided with roads, but a programme of new road construction is now being carried out. This point is of no great importance in so far as the actual tractor is concerned, but it is of extreme importance in so far as the marketing of produce is concerned, especially when it is remembered that increased crops can be expected as a result of tractor ploughing. The State Well Sinking Department have been carrying out work for some time in this District,

* Report on Raichur District Economic Investigation in the Hyderabad State, Volume V, Raichur District, by S. Keshava Iyengar, M.A., F.R.E.S., F.M.U., published by the Government Central Press, Hyderabad, Deccan, 1932.

and these activities will reduce considerably the difficulties felt both by men and cattle in regard to the supply of water. The cattle in the Raichur District are of a hard-working variety, and the amount of work obtained is amazing when the low rainfall, poor soil and inadequate fodder supply is considered.

The above survey of the district will give some idea of the conditions under which tractor ploughing has been carried out since 1930. The district was chosen because of its poverty and its low rainfall, factors which naturally received prominent consideration when the State authorities were considering the commencement of tractor ploughing. *Kundah* grass is also found in large quantities in the District and this could not be effectively eradicated by bullock ploughing, and due to scarcity of labour, hand-digging was definitely impossible and entirely uneconomical. Work in Raichur District was first started by the State in January 1931, when four Lanz Tractors with 'International' mouldboard Ploughs and 'brush-breaker' Ploughs were sent to Raichur. The season for tractor ploughing varies according to the state of rains, but normally the season starts early in December and continues until mid May. For the first season work was carried out by the State, which recovered the ploughing dues from the ryots, to whom *takavi* was granted. The rates for ploughing charged by the State, which included interest, were as follows :—

| Type of plough used. | Cash. | Rates per acre takavi. | |
|---|---|---|---|
| | | One Year. | Two Years. |
| | Rs. | Rs. | Rs. |
| Brush-breaker (one-furrow plough) . . . | 18 | 20 | 22 |
| Mouldboard (two-furrow plough) . . . | 12 | 13 | 14 |

The average minimum depth of ploughing during the 1930-31 season was 9″ and it was found that the rates fixed were not satisfactory. The brush-breaker being a one-furrow plough was definitely uneconomical, while at the rates fixed it was uneconomical to plough with a 2-furrow mouldboard plough. The system of fixed rates was abolished in 1931-32 season, and there is no doubt that it is more satisfactory to fix ploughing rates on a scale graded according to the depth to be ploughed. During the 1930-31 season one Lanz was exchanged for an International Harvester Tractor (McCormick-Deering) sent from Parbhani Agricultural Farm. During the first season's work, considerable difficulty and trouble was experienced with the Differentials of the Lanz tractors due to defects in the tempering of the axle and differential, which resulted in the breaking of the axle ; the Agents of Lanz Tractors (Messrs. Jessop & Co., Ltd., Calcutta) arranged for a new type of Differential Housing to be fitted, and this has been completely satisfactory. The new type of Differential Housing is now fitted to all Lanz Tractors sent to India. The

Lanz Tractor is described in detail in Chapter IX. The soil throughout the District is medium and heavy black cotton, and the depth ploughed did not exceed 10" which was sufficient to eradicate the *Kundah* grass. The Deputy Director's report on the growth of grass has already been quoted in Chapter II.

In September 1931, after some negotiations, Burmah-Shell agreed to take over the whole work of the project from the State Authorities, and continued work for the 1931-32 and 1932-33 seasons ; the State is now considering taking over the work again or alternatively handing over the plant to a contractor who will work under State supervision. Many difficulties were experienced in working the project, the chief being the distance of the work from the nearest rail head and the scattered nature of the areas to be ploughed. These points are covered more fully in Chapter IX, dealing with the organization of a Tractor Ploughing Project, but in considering the figures of the Raichur District, it must be borne in mind, that these difficulties were experienced and had some bearing on the final results. In order to ensure the best results, it is essential, that the lead from the rail head be reduced to a minimum and that the areas to be ploughed be as concentrated as possible.

The 1931-32 season lasted from 11th December 1931 until 30th May 1932 ; due to early rains work had to be stopped earlier than was first anticipated. The 1932-33 season lasted from 2nd January 1932 until 1st May 1933. During the two seasons 1931-32 and 1932-33, 3,445 acres were ploughed in all in 11,896 hours, which is equivalent to 0·29 acres per hour and 3·45 hours per acre.

A very considerable amount of time was spent in transport or lost due to no land being available. As far as transport is concerned, the loss of time was chiefly due to moving from field to field. In regard to time lost due to having no land available, this was due to insufficient areas being canvassed in concentrated blocks so as to enable complete units being moved from camp to camp. It is uneconomical to move a tractor in order to plough a few acres and rather than do this, it was often necessary for one tractor to stand idle.

The hours worked and spare part expenditure for each tractor were as follows :—

| Tractor. | Season. | Ploughing hours. | Spare part expenditure. |
|---|---|---|---|
| | | H. M. | Rs. A. P. |
| McCormick-Deering 15-30 (Nizam's) . . | 1931-32 | 1247 15 | 374 9 11* |
| Lanz— | | | |
| No. 1 . . . . . | 1932-33 | 886 50 | 354 7 5 |
| No. 2 . . . . . | 1931-32 | 1393 20 | 316 4 3 |
| | 1932-33 | 1293 20 | 372 4 2 |
| | | 2686 40 | 688 8 5 |

* Out of this amount Rs. 240 was the cost of spares replaced due to an accident.

| Tractor. | Season. | Ploughing hours. | Spare part expenditure. |
|---|---|---|---|
| | | H. M. | Rs. A. P. |
| Lanz— | | | |
| No. 3 | 1931-32 | 1391 50 | 1,285 8 5 |
| | 1932-33 | 1240 45 | 284 9 5 |
| | | 2632 35 | 1,570 1 10 |
| No. 4 | 1931-32 | 1450 55 | 28 1 6 |
| | 1932-33 | 744 30 | 283 4 5 |
| | | 2195 25 | 311 5 11 |
| No. 5 | 1931-32 Dharwar | 596 55 | 16 6 0 |
| | 1931-32 Raichur | 297 15 | 64 10 6 |
| | 1932-33 | 594 00 | 456 13 0 |
| | | 1488 10 | 537 13 6 |
| No. 6 | 1931-32 Dharwar | 227 35 | *Nil.* |
| | 1931-32 Raichur | 132 00 | 222 15 6 |
| | 1932-33 | 1196 35 | 368 9 0 |
| | | 1556 10 | 591 8 6 |

It will be noted that the spare part expenditure increased with each year of working, except in the case of Lanz No. 3 on which heavy expenditure was incurred during the first year due to a new Rear Axle and Rear Axle Housing having to be provided.

The following statements give full details of the cost per hour and per acre of tractor spares, plough spares, drivers and transit together with full details of fuel costs and fuel consumption. Separate figures are given for each season and for the combined seasons during which the tractors worked. Full statistics appear in Appendix A at the end of the monograph.

## *Summary of costs (other than fuel).*

*(In Rupees, annas and pies).*

| Tractor. | Season. | Area ploughed. Acres. | Tractor spares. | | Plough spares. | | Drivers. | | Transit. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| McCormick Deering 15-30 Unit No. 1 | 1931-32 | 303·65 | 1 3 9 | 0 4 4 | 1 4 5 | 0 4 6 | 1 15 0 | 0 6 10 | 0 11 10 | 0 2 7 |
| Lanz Unit— | | | | | | | | | | |
| No. 1 | 1932-33 | 158·25 | 2 3 10 | 0 5 3 | 3 4 10 | 0 7 9 | 3 1 7 | 0 7 4 | 0 13 2 | 0 1 11 |
| No. 2 | 1931-32 | 341·00 | 0 14 10 | 0 3 4 | 1 3 2 | 0 4 4 | 1 14 8 | 0 6 11 | 0 7 5 | 0 1 8 |
| | 1932-33 | 224·125 | 1 10 7 | 0 4 2 | 2 12 5 | 0 6 11 | 2 5 0 | 0 5 9 | 0 7 9 | 0 1 3 |
| No. 3 | 1931-32 | 320·9 | *4 0 1 | 0 13 6 | 0 14 7 | 0 3 1 | 2 0 4 | 0 6 10 | 0 9 8 | 0 2 0 |
| | 1932-33 | 226·7 | 1 4 1 | 0 3 3 | 3 5 3 | 0 8 8 | 1 15 9 | 0 5 1 | 0 6 8 | 0 1 1 |
| No. 4 | 1931-32 | 340·950 | 0 1 4 | 0 0 3 | 1 7 0 | 0 4 11 | 1 15 5 | 0 6 9 | 0 9 9 | 0 2 1 |
| | 1932-33 | 100·175 | 2 13 2 | 0 5 9 | 2 13 11 | 0 5 11 | 2 12 1 | 0 5 7 | 0 5 5 | 0 0 8 |
| No. 5 | 1931-32 | 226·24 | 0 12 9 | 0 2 10 | 0 1 2 | 0 0 3 | 2 13 2 | 0 10 0 | 0 13 4 | 0 3 0 |
| | 1932-33 | 95·00 | †4 12 11 | 0 10 8 | 3 0 9 | 0 6 9 | 5 1 5 | 0 11 4 | 0 11 8 | 0 1 7 |
| No. 6 | 1931-32 | 91·450 | ‡2 7 0 | 0 7 10 | 1 11 4 | 0 5 6 | 6 3 9 | 1 4 0 | 0 15 7 | 0 3 1 |
| | 1932-33 | 211·525 | 1 11 11 | 0 4 5 | 1 12 4 | 0 4 6 | 2 8 5 | 0 6 5 | 0 6 9 | 0 1 1 |

Lanz Unit No. 1. Heavy expenditure on plough spares due to wear on plough spares (Rs. 216), and general plough break-downs.

*Lanz Unit No. 3. High expenditure due to new rear axle housing (Rs. 456), rear axle (Rs. 105), and steering knuckle (Rs. 160).

†Lanz Unit No. 5. High expenditure due to new differential housing (Rs. 140), 2 bearing journals (Rs. 112) and to the tractor ploughing being very little owing to nearly half the total time being wasted due to no spares.

‡Lanz Unit No. 6. High expenditure due to new rear axle (Rs. 165). A very small acreage was worked due to the fact that over a third of the total time was wasted waiting for spares.

## *Fuel costs.*

*(In Rupees, annas and pies.)*

| Tractor. | Season. | Area ploughed. Acres. | PETROL (for starting). | | FUEL. | | LUBRICATING OIL. | | GREASE. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| McCormick Deering 15-30 Unit No. 1 | 1931-32 | 303·65 | 0 6 6 | 0 1 5 | 4 8 1 | 0 15 11 | 1 8 11 | 0 5 6 | 0 2 1 | 0 0 6 |
| Lanz Unit— | | | | | *Kerosene.* | | *Fuel oil.* | | | |
| No. 1 | 1932-33 | 158·25 | .. | .. | 3 3 1 | 0 7 6 | 2 1 9 | 0 5 0 | 0 2 5 | 0 0 4 |
| No. 2 | 1931-32 | 341·90 | 0 1 1 | 0 0 3 | 2 8 11 | 0 9 3 | 1 0 4 | 0 3 8 | 0 1 3 | 0 0 4 |
| | 1932-33 | 224·125 | .. | .. | 2 15 11 | 0 7 5 | 1 14 0 | 0 4 8 | 0 2 1 | 0 0 4 |
| No. 3 | 1931-32 | 320·9 | 0 0 11 | 0 0 2 | 2 5 10 | 0 8 0 | 0 15 9 | 0 3 4 | 0 1 10 | 0 0 5 |
| | 1932-33 | 226·7 | .. | .. | 2 13 5 | 0 7 5 | 1 13 6 | 0 4 10 | 0 2 1 | 0 0 4 |
| No. 4 | 1931-32 | 340·950 | 0 1 1 | 0 0 3 | 2 0 9 | 0 7 0 | 0 15 4 | 0 3 3 | 0 1 9 | 0 0 4 |
| | 1932-33 | 100·175 | .. | .. | 3 7 2 | 0 6 11 | 2 1 7 | 0 4 3 | 0 2 2 | 0 0 3 |
| No. 5 | 1931-32 | 226·24 | 0 0 6 | 0 0 1 | 2 13 9 | 0 10 2 | 1 2 3 | 0 4 1 | 0 2 11 | 0 0 8 |
| | 1932-33 | 95·00 | .. | .. | 3 3 3 | 0 7 2 | 1 5 11 | 0 4 5 | 0 3 0 | 0 0 5 |
| No. 6 | 1931-32 | 91·450 | 0 0 11 | 0 0 2 | 2 13 10 | 0 9 2 | 1 2 6 | 0 3 9 | 0 3 9 | 0 0 9 |
| | 1932-33 | 211·525 | .. | .. | 2 11 8 | 0 6 11 | 1 11 0 | 0 4 3 | 0 2 0 | 0 0 4 |

## *Fuel consumption.*

*(In gallons per acre and per hour.)*

| Tractor. | Season. | Area ploughed. Acres. | PETROL (for starting). | | FUEL. | | LUBRICATING OIL. | | GREASE. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| McCormick Deering 15-30 Unit No. 1 . | 1931-32 | 303·650 | ·265 | ·058 | 6·407 | 1·415 | ·471 | ·104 | ·366 | ·081 |
| | | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Lanz Unit— | | | | | | | | | | |
| No. 1 . . . . . | 1932-33 | 158·250 | .. | .. | 8·209 | 1·207 | ·818 | ·120 | ·439 | ·065 |
| No. 2 . . . . . | 1931-32 | 341·900 | ·0951 | ·021 | 5·390 | 1·218 | ·318 | ·071 | ·248 | ·056 |
| | 1932-33 | 224·125 | .. | .. | 7·701 | 1·198 | ·684 | ·107 | ·378 | ·059 |
| No. 3 . . . . . | 1931-32 | 320·900 | ·0799 | ·0168 | 5·285 | 1·113 | ·303 | ·064 | ·321 | ·067 |
| | 1932-33 | 226·700 | .. | .. | 7·303 | 1·188 | ·697 | ·113 | ·376 | ·061 |
| No. 4 . . . . . | 1931-32 | 340·950 | ·097 | ·021 | 5·503 | 1·177 | ·291 | ·062 | ·300 | ·064 |
| | 1932-33 | 100·175 | .. | .. | 8·869 | 1·118 | ·656 | ·095 | ·389 | ·049 |
| No. 5 . . . . . | 1931-32 | 226·24 | ·041 | ·009 | 6·056 | 1·346 | ·527 | ·117 | ·511 | ·113 |
| | 1932-33 | 95·000 | .. | .. | 8·247 | 1·147 | ·747 | ·104 | ·542 | ·075 |
| No. 6 . . . . . | 1931-32 | 91·45 | ·085 | ·017 | 6·058 | 1·215 | ·459 | ·092 | ·651 | ·131 |
| | 1932-33 | 211·525 | .. | .. | 7·042 | 1·118 | ·619 | ·098 | ·368 | ·059 |

## *Figures for combined seasons work.*

*(In Rupees, annas and pies.)*

| Tractor. | Season. | Area ploughed. Acres. | Tractor spares. | | Plough spares. | | Drivers. | | Transit. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| McCormick Deering 15-30 Unit No. 1 . | 1931-32 | 303·650 | 1 3 9 | 0 4 4 | 1 4 5 | 0 4 6 | 1 15 0 | 0 6 10 | 0 11 10 | 0 2 7 |
| Lenz Unit— | | | | | | | | | | |
| No. 1 . . . . . | 1932-33 | 158·25 | 2 3 10 | 0 6 5 | 3 4 10 | 0 9 6 | 3 1 7 | 0 8 10 | 0 13 2 | 0 1 11 |
| No. 2 . . . . . | 1931-33 | 566·025 | 1 3 5 | 0 4 1 | 1 13 1 | 0 6 2 | 2 1 2 | 0 7 0 | 0 7 7 | 0 1 5 |
| No. 3 . . . . . | 1931-33 | 547·600 | 2 13 11 | 0 9 6 | 1 14 7 | 0 6 4 | 2 0 8 | 0 6 8 | 0 8 5 | 0 1 7 |
| No. 4 . . . . . | 1931-33 | 441·125 | 0 11 4 | 0 2 3 | 1 12 2 | 0 5 8 | 2 2 4 | 0 6 11 | 0 8 9 | 0 1 8 |
| No. 5 . . . . . | 1931-33 | 321·24 | 3 10 4 | 0 10 2 | 2 6 3 | 0 6 8 | 5 10 3 | 0 15 10 | 0 13 7 | 0 2 5 |
| No. 6 . . . . . | 1931-33 | 302·975 | 1 4 1 | 0 3 9 | 0 14 3 | 0 2 8 | 2 10 10 | 0 8 0 | 0 10 2 | 0 1 11 |

## *Fuel costs.*

*(In Rupees, annas and pies.)*

| Tractor. | Season. | Area ploughed. Acres. | Petrol (for starting). | | Fuel. | | Lubricating oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| McCormick Deering 15-30 Unit No. 1 . | 1931-32 | 303·650 | 0 5 9 | 0 1 5 | 4 3 6 | 0 15 11 | 1 4 2 | 0 6 6 | 0 1 11 | 0 0 6 |
| | | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Lenz Unit— | | | | | | | | | | |
| No. 1 . . . . . | 1932-33 | 158·250 | .. | .. | 2 11 6 | 0 6 5 | 1 15 4 | 0 4 7 | 0 2 2 | 0 0 4 |
| No. 2 . . . . . | 1931-33 | 566·025 | 0 0 6 | 0 0 1 | 2 7 11 | 0 8 4 | 1 3 11 | 0 4 2 | 0 1 3 | 0 0 4 |
| No. 3 . . . . . | 1931-33 | 547·600 | 0 0 4 | 0 0 1 | 2 5 3 | 0 7 0 | 1 2 0 | 0 3 7 | 0 1 3 | 0 0 3 |
| No. 4 . . . . . | 1931-33 | 441·125 | 0 0 8 | 0 0 2 | 2 1 2 | 0 6 4 | 1 0 4 | 0 3 0 | 0 1 5 | 0 0 3 |
| No. 5 . . . . . | 1931-33 | 321·24 | 0 0 6 | 0 0 1 | 3 10 6 | 0 10 3 | 1 9 4 | 0 4 5 | 0 3 1 | 0 0 7 |
| No. 6 . . . . . | 1931-33 | 302·975 | 0 0 3 | 0 0 0½ | 2 12 9 | 0 8 4 | 1 6 6 | 0 3 6 | 0 2 5 | 0 0 5 |

## *Fuel consumption.*

*(In gallons per acre and per hour.)*

| Tractor. | Season. | Area ploughed. Acres. | PETROL (for starting). | | FUEL. | | LUBRICATING OIL. | | GREASE. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per Acre. | Per hour. |
| | | | | | *Kerosene.* | | | | | |
| McCormick Deering 15-30 Unit No. 1 | 1931-32 | 303·650 | ·235 | ·058 | 5·997 | 1·415 | ·380 | ·104 | ·327 | ·081 |
| | | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Lanz Unit— | | | | | | | | | | |
| No. 1 . . . . . | 1932-33 | 158·250 | .. | .. | 7·001 | 1·029 | ·733 | ·107 | ·389 | ·057 |
| No. 2 . . . . . | 1931-33 | 566·025 | .. | .. | 5·765 | 1·209 | ·419 | ·089 | ·234 | ·055 |
| No. 3 . . . . . | 1931-33 | 547·600 | .. | .. | 5·438 | 1·021 | ·413 | ·078 | ·225 | ·042 |
| No. 4 . . . . . | 1931-33 | 441·125 | .. | .. | 5·758 | 1·064 | ·336 | ·062 | ·254 | ·047 |
| No. 5 . . . . . | 1931-33 | 321·24 | ·042 | ·007 | 7·932 | 1·388 | ·606 | ·106 | ·551 | ·096 |
| No. 6 . . . . . | 1931-33 | 302·975 | ·021 | ·004 | 6·532 | 1·217 | ·572 | ·106 | ·435 | ·081 |

## CHAPTER V.

## SIND PLOUGHING PROJECT.

### General.

The area ploughed in Sind fell under two main heads—irrigated lands already under cultivation and uncultivated unirrigated lands. In the former type of land the soils are of a far more even texture than in the latter and disc ploughs were used satisfactorily, with a consequent saving in cost on account of the longer life of the discs compared to shares. All the cultivated area was in the Mirpurkhas District, whilst the unirrigated uncultivated land was all in the Government "Six-Farm" areas to which detailed reference is made later.

### Contract ploughing in Mirpurkhas district.

In order to enable zemindars and landlords to see tractors at work in their own fields and to obtain the direct benefit of tractor ploughing and also to enable accurate cost data regarding tractor ploughing to be obtained, arrangements were made to plough on contract an area totalling 1,394 acres belonging to zemindars in the Mirpurkhas District. The depth of ploughing tried was from 6″ to 7″ and the rate Rs. 6 per acre, which was fixed as a purely nominal amount intended partially to cover direct working expenses. It was made clear at the time to the zemindars for whom work was carried out that this rate would not be an economic rate for a firm or individual who wished to undertake contract ploughing as a livelihood. In this District the following tractor outfits were worked :—

(1) McCormick-Deering 22/36 Kerosene Tractor with a P. & O. No. 8 mouldboard plough of three bottoms with a total cut of 36″.
(2) John Deere 15/27 Kerosene Tractor with a John Deere three furrow mouldboard plough with a total cut of 42″.

Both the tractors were also tested with a four furrow John Deere disc plough which under even soil conditions gave very good results at a cost per acre about 25 per cent. below the cost per acre when a mouldboard plough was used.

Considerable difficulties were experienced in this area due to the following causes :—

(1) Shortage of spare parts both for tractors and ploughs not being readily available.
(2) Shortage of drivers due to sickness.
(3) Delay in effecting minor repairs due to want of workshop equipment.
(4) The division of the area into a number of small parts.

Although the area was a cultivated irrigated area, the land on which we worked was very dry and hard and this resulted in heavy expenditure on plough shares. In all 498 acres were ploughed in 746 working hours with the two outfits mentioned above and the following is a brief analysis of the more important data obtained. It must be remembered, however, that this work was the first carried out by Burmah-Shell and some of the difficulties enumerated above would be overcome by an experienced contractor.

| Description. | McCormick Deering. | John Deere. |
|---|---|---|
| Area ploughed | 338 acres | 234 acres. |
| Working time | 610 hours | 449 hours. |
| Fuel consumption per acre | 4·73 gallons | 5·43 gallons. |
| Fuel cost per acre | Rs. 3-4-0 | Rs. 3-11-0. |
| Total cost of spares | Rs. 852-0-0 | Rs. 1,017-0-0. |
| Cost of spares per acre | Rs. 2-8-0 | Rs. 4-6-0. |
| Hours per acre | 1·81 hours | 1·91 hours. |
| Area per hour | 0·55 acre | 0·52 acre. |

### Government six-farm scheme—Sind.

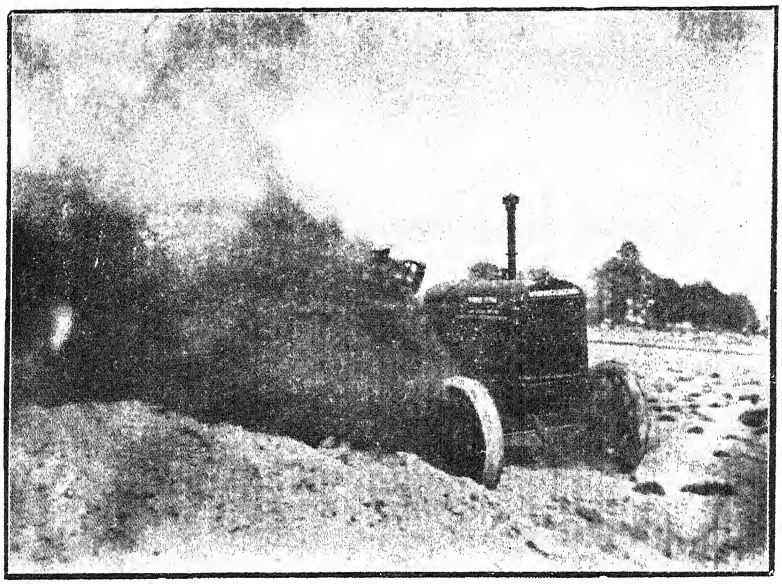
In connection with the opening of the Sukkur Barrage area, Mr. W. J. Jenkins, Chief Agricultural Officer in Sind, put up to the Government of Bombay a scheme whereby the Bombay Government would finance the running of six experimental farms, the total acreage of which amounted to between 2,000 and 3,000 acres, all of which were of course unirrigated and uncultivated at the time. Most of the area was virgin soil, and the whole land required ploughing before it could be brought under cultivation. It was the original intention of the Bombay Government to appoint an Agricultural Engineer to the Sind area to examine the whole question of mechanical ploughing with a view to preparing the ground for the time when the Barrage water would be available, but due to financial stringency

this appointment had to be cancelled and consequently the Bombay Government were unable to make any experiments with tractors on their own account. The "Six-Farm" Scheme proposal of Mr. Jenkins, however, received Government support and it was proposed to open up six farms before March 1932 and definite financial provision was made to enable ploughing work to be commenced on three of the six farms during the financial year ending 31st March 1931. The total area to be opened up on the six farms was 1,200 acres, so that large compact areas were available. After considerable discussion and negotiations between Burmah-Shell and the Bombay Government, who required 1,200 acres ploughed by the end of March 1931, Burmah-Shell agreed to do the work on contract at Rs. 7 per acre on the condition that Government first cleared the area of the scrub jungle and other cultivation. (This rate was subsequently increased to Rs. 8.)

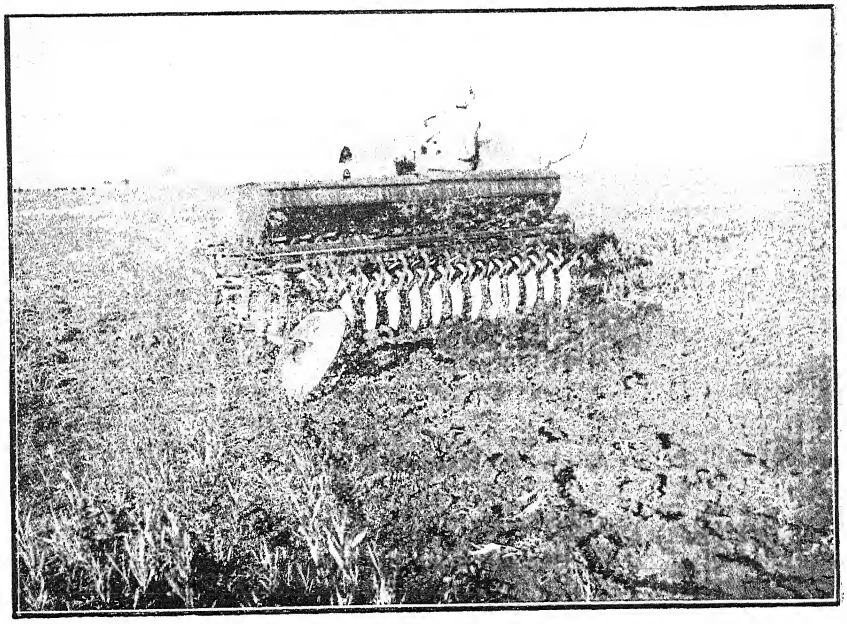
One 22/36 McCormick-Deering Kerosene tractor, one 12/27 John Deere Kerosene tractor and one 15/30 Marshall Diesel tractor were used on this scheme together with two Ransome Vice-Consul disc ploughs, one P. & O. No. 8 three furrow mouldboard plough and one John Deere three furrow mouldboard plough. Work was first commenced on the Dadu farm on the 20th of February 1931 with the two Kerosene tractors, and a considerable amount of difficulty was experienced in working on this farm due to the bad soil conditions. There were sandy patches over almost the whole of the area to be ploughed and this resulted in the tractors being unable to plough to the correct depth in some parts, and in certain portions where the sand was very deep ploughing could not be carried out at all. To start with Ransome disc ploughs were used, but due to the uneven nature of the soil and the large sand drifts this type of plough was not a success and more satisfactory results were obtained with mouldboard ploughs. During the work on the "Six-Farm" Scheme 1,193 acres were ploughed, but at four farms only, *viz.*, Dadu, Padidan, Lundo and Oderolal. (Pl. IV, fig. 1.) This work was referred to in the Annual Report of the Department of Agriculture in Sind for the year 1930-31 as follows :—

> "The co-operation of the Burmah-Shell Co. Ltd., Karachi, in tractor ploughing the farm sites, without which it would not have been possible to have the areas ready for cultivation in 1932, is acknowledged in another section of the report."

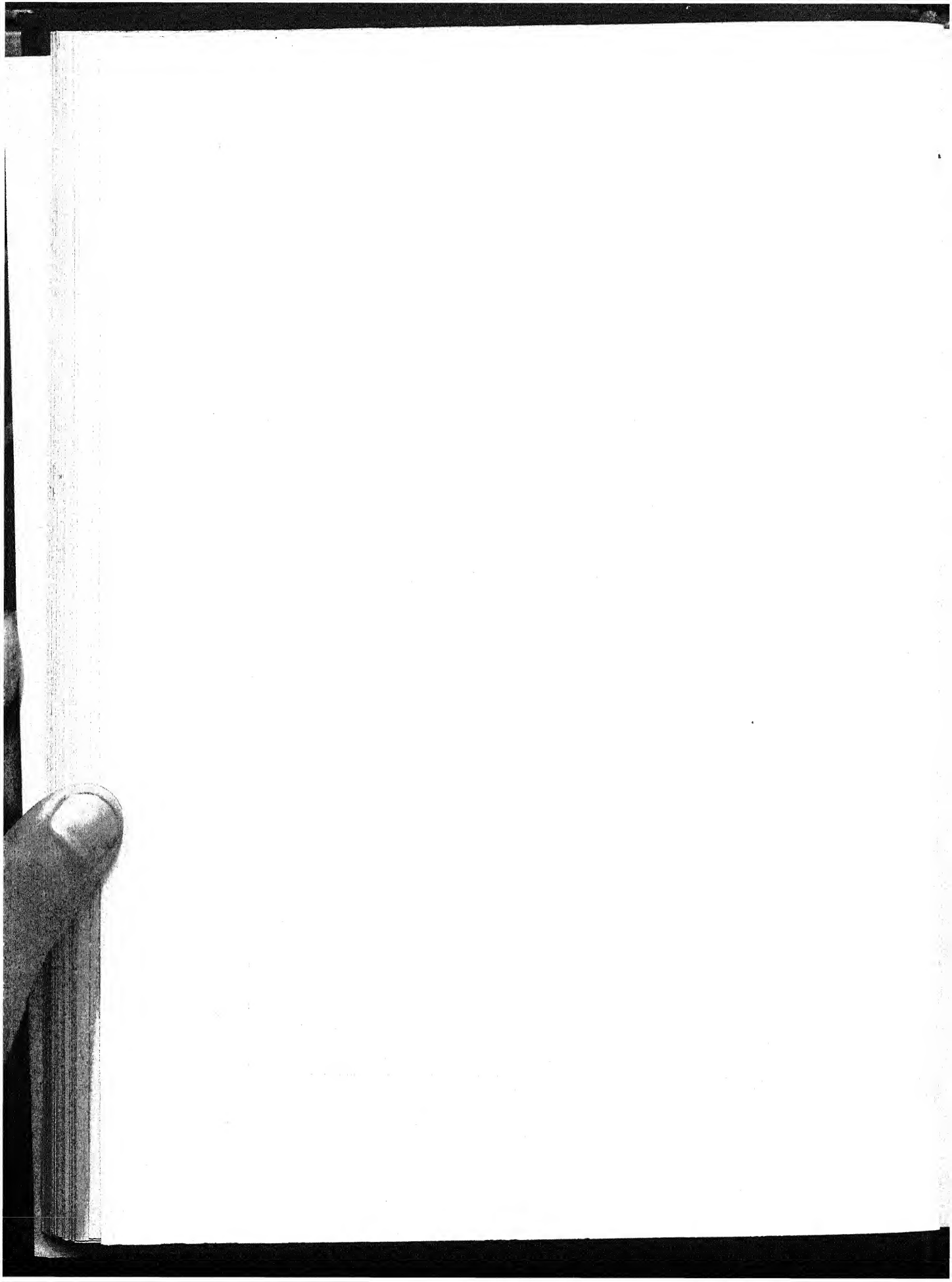
> "(57) *Tractor ploughing.* During the year under report, the Burmah-Shell Company of India, Ltd., has co-operated with the Agricultural Department in extensive experiments on tractor ploughing of virgin lands in the Barrage areas. The areas utilised for this work were the sites of the new demonstration farms, sanctioned under the 'Six-Farm Scheme'. These lands were cleared of jungle and undergrowth and roughly levelled by the Agricultural Department and were subsequently ploughed by the staff of the Development Department of the Burmah-Shell Company, Ltd., at a fixed rate of Rs. 8 per acre. The machines



1. Tractor ploughing in Sind (page 34).



2. Combine Tiller at work (page 38).



used were a McCormick Deering 22/36 H. P. 4-Cyl. kerosene oil tractor, a John Deere 'D' model 12/27 H. P. 2-Cyl. kerosene oil tractor, and latterly a Marshall 15/30 H. P. 1-Cyl. crude oil tractor (Diesel Engine), with various types of disc and mouldboard tractor ploughs. At the Dadu, Padidan and Oderolal sites, 953 acres of land have been ploughed under this arrangement and work is proceeding at the Lundo site with the Marshall Diesel Tractor only. A full report on the results of this co-operative experiment will be prepared when the work is finally completed. The thanks of the Department are due to the Burmah-Shell Co. Ltd., for their willingness to co-operate in these trials which will supply valuable information with regard to practical aspects of tractor cultivation over a wide area of Barrage lands and which have enabled the Department to get the sites of the new farm rapidly prepared for cultivation soon after the opening of the Barrage Canals System."

Full details of the cost of this work are given in Appendix A and at the end of the Chapter is given an analysis of the costs of the work on the Government Farm Scheme, extracted from the statistical statements contained in Appendix A.

| —— | McCormick Deering 22/36. | John Deere 12/27. | Marshall 15/30. |
|---|---|---|---|
| Area ploughed . . . | 334 acres | 760 acres | 99 acres. |
| Ploughing time . . . | 528 hours | 1,197 hours | 221 hours. |
| Fuel per acre . . . | 3·86 gallons | 3·52 gallons | 2·81 gallons. |
| Fuel per acre cost . . | Rs. 3-2-6 | Rs. 2-10-0 | Rs. 1-3-6. |
| Total value of spares . . | Rs. 687-1-10 | Rs. 1,704-3-8 | Rs. 273-12-2. |
| Cost of spares per acre . . | Rs. 2-0-11 | Rs. 2-3-10 | Rs. 2-12-3. |
| Hours per acre . . . | 1·58 hours | 1·58 hours | 2·23 hours. |
| Acre per hour . . . | 0·63 acre | 0·63 acre | 0·45 acre. |

## General.

The following abstracts from the detailed statistics contained in Appendix A will be of use to those unable to spare the time to study the full statements. Details of fuel consumption, spare parts, drivers and other expenditure per hour and acre are given.

## *Summary of costs (other than fuel).*

*(In Rupees, annas and pies.)*

| Tractor. | Area ploughed. | Tractor spares. | | Plough spares. | | Drivers. | | Transit. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | Acres. | | | | | | | | |
| John Deere 12/27 H. P. . . . | 760·0 | 2 10 11 | 1 11 0 | 0 7 1 | 0 4 5 | 1 7 11 | 0 13 1 | 0 0 4 | 0 0 2 |
| Marshall 15/30 H. P. . . . | 99·0 | 1 12 3 | 0 12 8 | 0 8 0 | 0 3 7 | 5 14 6 | 2 10 4 | .. | .. |
| McCormick Deering 22/36 . . | 334·0 | 1 2 7 | 0 11 9 | 0 14 0 | 0 9 1 | 2 6 10 | 1 8 7 | 0 0 10 | 0 0 6 |

## *Fuel consumption.*

*(In gallons per acre and per hour.)*

| Tractor. | Area ploughed. | Petrol. (For starting only.) | | Fuel. | | Lubricating oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | Acres. | | | *Kerosene.* | | | | | |
| John Deere 12/27 H. P. . . . | 760·0 | 0·114 | 0·073 | 3·520 | 2·237 | 0·570 | 0·363 | 0·171 | 0·109 |
| McCormick Deering 22/36 . . | 334·0 | .. | .. | 3·826 | 2·443 | 0·368 | 0·233 | 0·309 | 0·195 |
| | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Marshall 15/30 H. P. . . . | 99·0 | 0·071 | 0·032 | 2·838 | 1·271 | 0·417 | 0·187 | 0·333 | 0·149 |

## *Fuel costs.*

*(In Rupees, annas and pies.)*

| Tractor. | Area ploughed. | Petrol. (For starting only.) | | Fuel. | | Lubricating oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | Acres. | | | *Kerosene.* | | | | | |
| John Deere 12/27 H. P. . . . | 760·0 | 0 2 10 | 0 1 10 | 2 10 0 | 1 10 9 | 0 11 10 | 0 7 7 | 0 0 1½ | 0 0 1 |
| McCormick Deering 22/36 . . | 334·0 | .. | .. | 3 3 0 | 2 0 2 | 0 9 0 | 0 5 8 | 0 2 6 | 0 1 7 |
| | | *Kerosene.* | | *Fuel oil.* | | | | | |
| Marshall 15/30 H. P. . . . | 99·0 | 0 0 11 | 0 0 5 | 1 3 4 | 0 8 8 | 0 11 4 | 0 5 9 | 0 1 7 | 0 0 9 |

## CHAPTER VI.

## POWER FARMING PROJECT.

It has been mentioned in the course of the previous Chapters that in order to be really economical a tractor must be employed on other operations than ploughing, although for sufficiently large areas a tractor can be economically employed on deep ploughing alone. The average landholder, as distinct from the contractor, has not a sufficient area requiring deep ploughing to justify the purchase of a tractor for this work only and it is necessary therefore to consider whether other minor operations such as harrowing can be carried out at rates competitive with the existing rates for bullock work. With this object in view an experiment was carried out near Kundgol in the Jamkhandi State (Bombay) and near Annigeri in the Dharwar District, Bombay Presidency, during the summer of 1933 when shallow ploughing, harrowing and sowing was done with a Marshall 15/30 H. P. Single Cylinder two stroke Semi-Diesel Tractor and a McCormick-Deering 15/30 H. P. Kerosene Tractor, together with a Cockshutt Combine Tiller and McCormick Deering Field Cultivator, full details of and comments on which are given below.

The Combine Tiller is a comprehensive combination of a harrow plough and seed drill and, when operated without the seeding attachment, it has the combined features of a disc plough and harrow. A series of discs similar to a disc harrow are spread evenly along a shaft, but are set at a much broader angle, resulting in the earth being thrown in one direction only. The discs are held in place by heavy wheels, which work at a similar angle to a disc plough. The plough is raised and lowered by the introduction of a strong power lift operated on the land wheel. The depth is adjustable from surface skimming to 8″ in light soils and approximately 6″ in black cotton soils, which are under cultivation and are free from *hariali* and *kans*. The front furrow wheel is controlled by the hitch for turning, and both furrows are 'V' shaped to enable them to hold the furrow wall. Wheel weights are provided for heavy soil conditions and extension wheel bands for light loose soils. Although this implement is built on the same principle as the harrow plough, wheat land plough and one-way plough, it is more suited for different types of soil conditions due to the shape of the discs, which are set at a wider angle and are more concave.

The introduction of this implement has enabled the cost of shallow ploughing for stubble land to be greatly reduced and, when worked in conjunction with the seed box and culti-packer, enables ploughing, harrowing, sowing and culti-packing to be carried out in one operation. Apart from reducing the cost of production, it also eliminates the necessity of the tractor to cross the ploughed field for the sowing and culti-packing operations.

When the seed bed for wheat is being prepared by bullock power, the following operations are necessary. At least four harrowings with a blade harrow are given, the object of this being to consolidate slowly the soil sufficiently to give the wheat crop a firm footing and to keep enough mulch to retain the moisture. With the use of a Combine Tiller (Pl. IV, fig. 2), the first ploughing is not only deeper but completely even below ground and the soil is left in such a good condition that it will absorb and retain more moisture. The second operation of ploughing, harrowing and culti-packing enables the seed to be sown at an even depth and at a given quantity per acre and it is evenly spread, which is not the case with hand sowing. The culti-packer not only packs the soil but at the same time leaves the required ridge formation to stop the soil being blown by the wind.

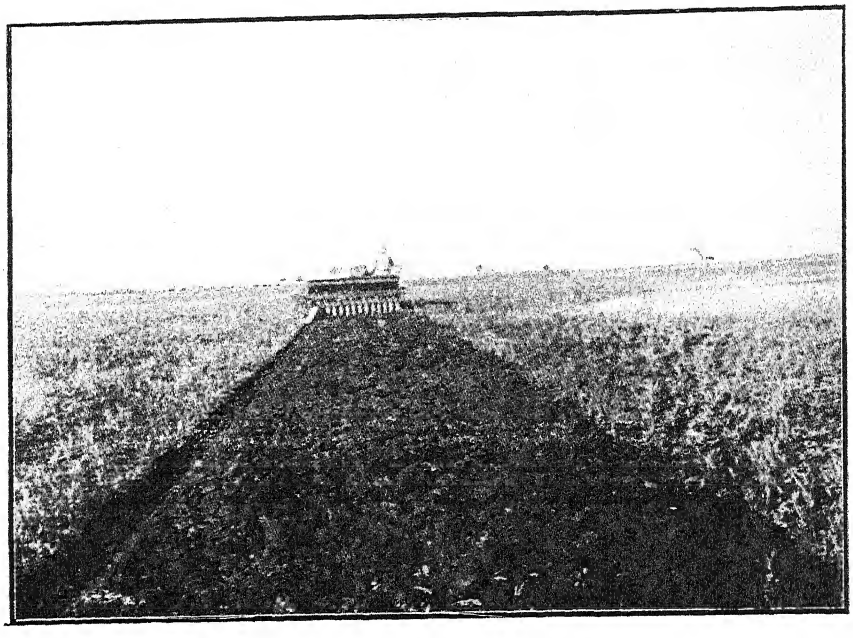
The tiller used on this project had a cut of 8′ and could plough up to 14 furrows for a maximum of 6″ depth in heavy soils and 8″ in light soils.

Unfortunately the summer of 1933 was abnormal, as far as the rains were concerned, and exceptionally early and late rains were encountered with the result that the working season was very much shorter than anticipated when the work was started. In all 258·375 acres were ploughed, 51·15 acres harrowed and 10 acres were sown. It is claimed that although the acreage for the harrowing and sowing operations was small, it was sufficiently large to enable some definite decision to be arrived at regarding the practicability and economics of the work. The sowing operations in particular were very considerably handicapped by the rains which went on very much longer than usual and completely waterlogged the land.

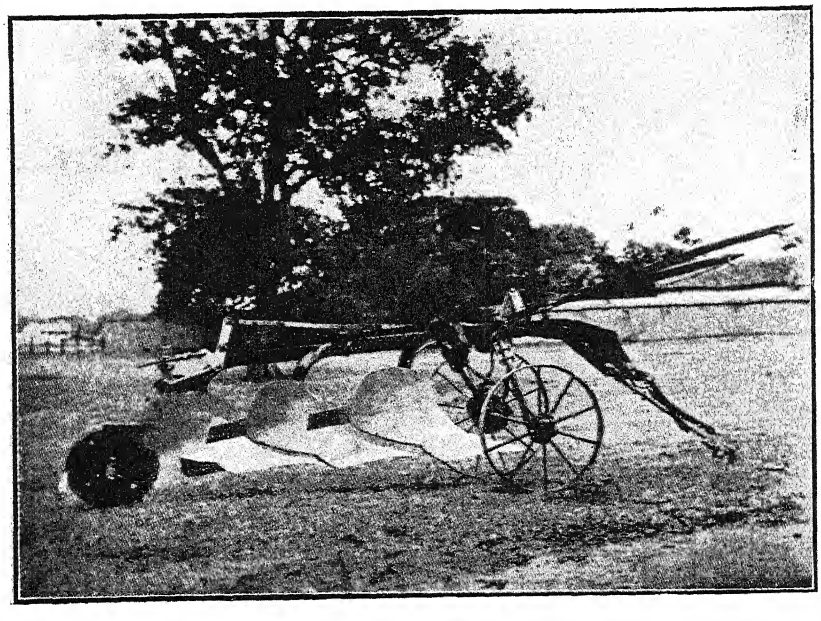
It was the local practice to carry out at least four harrowings of wheat lands to ensure slow consolidation of and a compact foundation for the seed bed. With this practice Burmah-Shell did not entirely agree, as it was thought that with the use of a Combine Tiller the harrowing operations could be eliminated and equally satisfactory results obtained. Two separate operations only would then be required with a Combine Tiller and a culti-packer attached to the Tiller—first shallow ploughing and then ploughing, sowing and culti-packing in one operation, which results in the seed being sown on a farm, but not too tightly packed seed bed over which the surface soil is left in a mulch and in ridges, which preserves the moisture and stops the soil being blown about. Work was moved to Kundgol as it was the local practice at Annigeri to have tillage operations done during the rains. At Kundgol the Combine Tiller only was used and no culti-packer was available—so the results obtained were not so satisfactory as they might have been. Even so the results obtained were more satisfactory than on the land worked by bullocks. The Deputy Director of Agriculture reported that the growth of the cotton crops at Annigeri on the lands tilled with the Combine Tiller was better than on lands cultivated by local methods.

The use of the Combine Tiller therefore eliminates several bullock operations and results in increased crops, even without a culti-packer and the scope for this

PLATE V.



1. Combine Tiller Ploughing 5″ deep (page 39).



2. P. & O. No. 5 Mould board Plough fitted with 4″ extensions (page 55).

type of work is therefore very large. One of the most important results so far as this particular experimental work is concerned was the establishment of the fact that numerous harrowings are not necessary to ensure that adequate consolidation of the seed bed required for wheat.

For cotton lands a separate sowing implement is necessary also for intercultivation and ploughing alone was carried out with the Combine Tiller.

At the end of this Chapter an analysis of the cost of various work is given and the following is a summarised analysis of the costs of the three operations.

### Ploughing (3″ to 4″ with combine tiller).

258·375 acres were ploughed in 196 hours 35 minutes. The cost per hour was Rs. 1-9-1 and the cost per acre was Rs. 1-3-2, exclusive of interest and depreciation; inclusive of interest and depreciation the cost per acre increased to Rs. 2-6-11 and the cost per hour to Rs. 3-4-0.

The consumption of kerosene oil was 0·15 and 0·11 gallon per hour and per acre respectively and of fuel oil 1·27 and 0·096 per hour and per acre respectively. The lubricating oil consumption was 0·16 and 0·12 gallon per hour and per acre respectively, and of grease 0·11 and 0·09 lb. per hour and per acre respectively.

### Harrowing.

51·15 acres were harrowed in 41 hours and 35 minutes. The cost per hour was Rs. 1-10-6 and the cost per acre was Rs. 1-5-9, exclusive of interest and depreciation; inclusive of interest and depreciation the cost per acre increased to Rs. 2-11-6 and the cost per hour to Rs. 3-5-6.

The consumption of kerosene oil was 0·22 and 0·16 per hour and per acre respectively and of fuel oil 1·51 and 1·22 gallons per hour and per acre respectively. The lubricating oil consumption was 0·12 and 0·10 gallons per hour and per acre respectively and of grease 0·20 and 0·16 lbs. per hour and per acre respectively.

### Sowing (wheat land only).

10 acres were sown in 9 hours. The cost per hour was Rs. 2-4-10 and the cost per acre was Rs. 2-1-2, exclusive of interest and depreciation; inclusive of interest and depreciation the cost per acre increased to Rs. 3-9-5 and the cost per hour to Rs. 3-15-9.

The consumption of kerosene oil was 2·00 and 1·80 gallons per hour and per acre respectively. The lubricating oil consumption was 0·10 and 0·11 per hour and per acre respectively.

# Tractor Operating Statement.

*Power Farming.*

Period 19th June 1933 to 8th November 1933.

Tractor Unit No.—
Marshall . . 19th June to 27th Aug.
McCormick Deering 28th Aug. to 8th Nov.

Location—Annigeri and Kundgol.

Implements—Combined Fodder and Orchard Cultivator.

| | | Direct Charges. Labour. Drivers' Wages. | Fuel—Lubricants. Petrol. Gallons. | Petrol. Rs. A. P. | Fuel or K. Oil Rate. Gallons. | Fuel or K. Oil Rate. Rs. A. P. | Lubricating Oil Rate. Gallons. | Lubricating Oil Rate. Rs. A. P. | Grease Rate. Lbs. | Grease Rate. Rs. A. P. | Materials. Spare Parts. | Materials. Repairs and Sundries. | Allocation Maintenance cost.* | Total. | Cost Summary Direct Charges. Acres ploughed or cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Overhead Charges Owner-Operator. Interest. | Depreciation. | Total. | Cost Summary Owner-Operator. Cost per Hour. | Cost per Acre. | Overhead Charges Contractor-Operator. Supervisors' Salaries. | Supervision, Other Expense. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation | Ploughing | 131 2 8 | 249 | 77 13 0 | 29 | 19 4 0 | E 23 L 8 | 75 9 0 | 22 | 5 2 6 | .. | .. | .. | 308 15 2 | 258-15 | 196-35 | 1 9 1 | 1 3 2 | 192 15 11 | 137 13 0 | 639 12 1 | 3 4 0 | 2 6 11 | .. | 24 7 0 |
| | Harrowing | 27 12 0 | 62½ | 19 9 11 | 9 | 5 15 8 | E 5 | 14 1 0 | 8½ | 1 15 11 | .. | .. | .. | 69 6 6 | 51-6 | 41-35 | 1 10 6 | 1 5 9 | 40 13 2 | 28 15 0 | 139 2 8 | 3 5 6 | 2 11 6 | .. | 5 2 7 |
| | Sowing | 6 0 0 | .. | .. | 18 | 11 15 4 | E 1 | 2 13 0 | .. | .. | .. | .. | .. | 20 12 4 | 10-0 | 9-0 | 2 4 10 | 2 1 2 | 8 13 4 | 6 4 6 | 35 14 2 | 3 15 9 | 3 9 6 | .. | 1 1 11 |
| Maintenance | Tractor | 13 9 4 | 4¾ | 4 12 3 | 27 | 17 14 11 | E ½ | 1 14 6 | 13½ | 3 2 8 | 61 10 0 | 30 10 0 | .. | 133 9 8 | .. | 20-21 | .. | .. | .. | .. | 133 9 8 | .. | .. | .. | 2 8 5 |
| | Ploughs, etc. | 9 10 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 9 10 8 | .. | 14-29 | .. | .. | .. | .. | 9 10 8 | .. | .. | .. | 1 12 9 |
| Transit | | 26 6 11 | 25½ | 7 14 3 | 39 | 25 14 4 | 15½ | 43 9 6 | 3½ | 0 13 2 | .. | .. | .. | 104 10 2 | .. | 39-25 | .. | .. | .. | .. | 104 10 2 | .. | .. | .. | 4 14 3 |
| General | Canvassing | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | Organisation | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | Transport, Camping and Idle time. | 70 1 1 | .. | .. | 9 | 6 15 7 | 4 | 11 4 0 | .. | .. | .. | .. | .. | 88 4 8 | .. | 105-15 | .. | .. | .. | .. | 88 4 8 | .. | .. | .. | 13 2 10 |
| | TOTAL | 284 10 8 | 341¾ | 110 1 5 | 131 | 87 15 10 | 56¾ | 149 3 0 | 47½ | 11 2 3 | 61 10 0 | 30 10 0 | .. | 735 5 2 | 319-21 | 426-40 | .. | .. | 242 10 5 | 173 0 6 | 1,151 0 1 | .. | .. | .. | 53 1 9 |

Tractor Unit No.—
Marshall . . 19th June to 27th Aug.
McCormick Deering 28th Aug. to 8th Nov.

Location—Annigeri and Kundgol.

Implements—Combined Fodder and Orchard Cultivator.

| | | Transit and General. | Final Cost Summary Contractor-Operator. Total. | Cost per Hour. | Cost per Acre. | Memorandum. Rate per Acre per Hour. | Earnings. |
|---|---|---|---|---|---|---|---|
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation | Ploughing | .. | 664 3 1 | 3 6 1 | 2 9 1 | 1 0 0<br>2 0 0 | 429 1 0 |
| | Harrowing | .. | 144 5 3 | 3 7 6 | 2 13 2 | 0 7 0 | 35 15 0 |
| | Sowing | .. | 37 0 1 | 4 1 9 | 3 11 2 | Included in Ploughing. | |
| Maintenance | Tractor | .. | 136 2 1 | .. | .. | .. | .. |
| | Ploughs, etc. | .. | 11 7 5 | .. | .. | .. | .. |
| Transit | | .. | 109 8 5 | .. | .. | .. | .. |
| General | Canvassing | .. | .. | .. | .. | .. | .. |
| | Organisation | .. | .. | .. | .. | .. | .. |
| | Transport, Camping and Idle time. | .. | 101 7 6 | .. | .. | .. | .. |
| | TOTAL | .. | 1,204 1 10 | .. | .. | .. | 465 0 0 |

Data.

| Item. | Description. | Cost purchase price. | Estimated Life of—— hrs. | Depreciation at Rate amount ..... per Annum or Rs.... per hour. | Interest at Rate 6 per cent. per annum or Rs.... per month on the basis of 6 ploughing months. |
|---|---|---|---|---|---|
| | | Rs. | Hours. | Rs. A. P. | Rs. A. P. |
| Tractor | Marshall | 4,837 | 8,000 | 173 0 6 | 242 10 6 |
| | McCormick Deering. | 4,000 | | | |
| Ploughs or Implements. | Combine Tiller | 300 | | | |
| | Orchard Cultivation. | 549 | | | |
| TOTAL | .. | 9,686 | 8,000 | 173 0 6 | 242 10 6 |
| Camp | .. | 500 | 2 years | .. | .. |
| Equipment | .. | .. | .. | .. | .. |
| Share chargeable to General Account. | | | | | |

| Condition. | No. of Hours. | Percentage. | Description. |
|---|---|---|---|
| Ploughing | 196-35 | 46·31 | Ploughing |
| Harrowing | 41-35 | 9·74 | |
| Sowing | 9-0 | 2·11 | |
| Maintenance—Tractor. | 20-21 | 4·77 | Harrowing |
| Maintenance—Plough. | 14-29 | 3·37 | |
| Transit | 39-25 | 9·29 | |
| General | 105-15 | 24·41 | Sowing |
| TOTAL | 426-40 | 100 | |

Consumption.

| Fuel. Kerosene. Per Hour. | Fuel. Kerosene. Per Acre. | Fuel. Fuel Oil. Per Hour. | Fuel. Fuel Oil. Per Acre. | Lubricating Oil. Per Hour. | Lubricating Oil. Per Acre. | Grease. Per Hour. | Grease. Per Acre. |
|---|---|---|---|---|---|---|---|
| Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| ·15 | ·11 | 1·27 | ·096 | ·16 | ·12 | ·11 | ·09 |
| ·22 | ·16 | 1·51 | 1·22 | ·12 | ·10 | ·20 | ·16 |
| 2·00 | 1·80 | .. | .. | ·10 | ·11 | .. | .. |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of Hours employed on each operation.

## CHAPTER VII.

## TRACTORS.

### General.

For some years many manufacturers of tractors regarded India as a country where machines could be sold merely because they have been sold successfully in other countries. That this was unwise is shown by the many broken-down tractors and other agricultural machines that are to be seen in various parts of the country, and by the complete lack of confidence that exists among agriculturists without personal practical experience in modern agricultural machinery. The need for a close study of the actual conditions on the spot has already been stressed and this matter was referred to in the 11th Report of the Imperial Economic Committee entitled " A Survey of the Trade in Agricultural Machinery " from which the following is an extract :—

> " The Indian market may be taken as a striking example of great possibilities with the present small development ..... The Indian market differs radically from the markets of the Dominions and America. The great sub-division and scattered nature of agricultural holdings and the general social and economic systems in the villages render unsuited for India many of the agricultural machines and implements in common use in Temperate Zones. Cheapness and simplicity in design are essential. A cultivator is naturally slow to discard the type of implements which have sufficed for his ancestors. Much harm is done by the injudicious advertisement and pushing of machines not really suited to local conditions. Many of the villages are far from the main ports and large towns and the stocking and distribution of spare parts is expensive and difficult. The number of farmers is immense, and a great market would open out were the use of agricultural machinery to become more general, but many of the implements now used suffice for the present farming conditions."

There is little doubt that if manufacturers adapt their machinery to Indian conditions and, if adequate provision is made for rapid service and maintenance, there will be a large increase in the sale of agricultural machinery. One of the objects of Burmah-Shell's experiments has been to determine which types of tractors and implements are most suited to Indian conditions and what is the ideal tractor for general work, and also the ideal tractor for deep ploughing work for weed eradication ; the question of suitable implements to be used with different tractors has also been studied. Such problems as these should continue to be studied on the spot by men of practical experience and if as a result implements of a suitable nature are designed and imported at economic rates there will be a steadily growing demand

for such machinery. These views are also authoritatively confirmed by the Imperial Economic Committee, a further extract from whose 11th Report reads as follows :--

> "The markets for agricultural machinery in those countries in which it is at present little used possess possibilities, but their development is likely to be slow. Thorough study of local requirements, knowledge of the local methods of sale and complete organisation for spare parts and repairs are essential. This organization is expensive to develop and maintain. These considerations point to joint action by manufacturers, rather than to competing efforts by a number of firms, especially when these firms work through general agency houses and not through their own representatives."

Some valuable work in connection with experiments to determine suitable types of tractors and implements has been done by Agricultural Departments through the organization of tractor schools. In addition to carrying out a certain amount of practical experimental work these schools give valuable practical training to agriculturists. For example the Agricultural Department of the Bombay Government in conjunction with Burmah-Shell arranged a tractor school at Poona in 1931 and one at least of the students attending the course obtained good results and value from it. This student, M. C. Patel, a landlord owning a few hundred acres in Kundgol, Jamkhandi State, attended the course in order to acquire some knowledge and experience of modern methods of cultivation. He passed out 2nd from the school and then, in order to acquire yet further experience, took employment with Burmah-Shell as one of their tractor drivers at Raichur, after which he returned to his lands at Kundgol and bought a tractor with the assistance of a loan from the State. With this tractor he deep ploughed his own lands and also carried out contract work on other landlords' lands—the yield from his own tractor ploughed lands was 13 mds. per acre of cotton against 3 mds. per acre on bullock ploughed lands—the value per maund is approximately Rs. 2-8-0, so the cost of deep ploughing was recovered in the first year. By practical methods this young landlord has learnt the value of modern farming methods and is far better off as a result of his enterprise than if he had stayed at home and farmed his lands according to custom. If he had not been given sound practical education the results would, no doubt, have been different and he might even have gone to seek work in the cities and left his land uncultivated.

### Spare parts and maintenance.

The maintenance of adequate spare part facilities and of prompt, efficient service has been touched upon already, but the importance of this cannot be over-emphasized or mentioned too often, because on the adequate and prompt supply of spare parts depends the success of satisfactory and economical working of the tractor. In addition to the storing of spares at main ports, complete stocks of spare parts

should be kept at all large up-country agricultural centres in the care of responsible agents who should be in a position to despatch any spare the same day as the indent is received. During the three seasons in which Burmah-Shell were carrying out practical experiments in tractor ploughing in various parts of India, a very large percentage of time was lost due to agents being unable to supply spare parts from stock, although the importance of having adequate supply had always been emphasized by the Company. The following instances of time lost due to lack of spare parts will show more clearly than any words how necessary it is for this question to be appreciated both by the owners and by the sellers of tractors.

*Time lost due to lack of spares.*

| Location. | Unit No. | Tractor. | Season. | Hours. | Minutes. | TOTAL. Hours. | TOTAL. Minutes. |
|---|---|---|---|---|---|---|---|
| Dharwar | 1 | Caterpillar | 1931-32 | 201 | 40 | 201 | 40 |
| | 2 | Lanz | 1931-32 | 321 | 50 | .. | .. |
| Raichur | 5 | Lanz | 1931-32 | 5 | .. | .. | .. |
| | 5 | Lanz | 1932-33 | 1,214 | 15 | 1,541 | 5 |
| Dharwar | 3 | Lanz | 1931-32 | 596 | 15 | .. | .. |
| Raichur | 6 | Lanz | 1931-32 | 262 | 15 | .. | .. |
| | 6 | Lanz | 1932-33 | 241 | 45 | 1,100 | 15 |
| Dharwar | 4 | McCormick-Deering 15/30 | 1931-32 | 272 | .. | .. | .. |
| | 1 | | 1932-33 | 233 | .. | 505 | .. |
| Dharwar | 3 | McCormick-Deering 22/36 | 1932-33 | 288 | .. | 288 | .. |
| Raichur | 1 | McCormick-Deering 15/30 | 1931-32 | 349 | 30 | 349 | 30 |
| Raichur | 2 | Lanz | 1931-32 | 429 | 30 | .. | .. |
| | 2 | Lanz | 1932-33 | 177 | .. | 606 | 30 |
| Raichur | 3 | Lanz | 1931-32 | 438 | 45 | .. | .. |
| | 3 | Lanz | 1932-33 | 206 | 40 | 645 | 25 |
| Raichur | 4 | Lanz | 1931-32 | 399 | 45 | .. | .. |
| | 4 | Lanz | 1932-33 | 1,725 | .. | 2,124 | 45 |
| Raichur | 1 | Lanz | 1932-33 | 482 | 30 | 482 | 30 |
| | | | | | TOTAL | 7,844 | 30 |

During the two seasons 1931-32 and 1932-33, 7,844 working hours were lost due to spare parts being unavailable and this despite every effort being made to ensure agents maintaining adequate stocks. Tractor and plough agents will kill their own business if they do not take a far longer-sighted view of this matter and if they are not prepared to invest larger sums in spare part stocks.

## Details and specifications of tractors.

During the three seasons from 1930 to 1933 the following tractors have been in use for regular contract ploughing.

| Name of tractor. | Where worked. | Soil conditions. |
|---|---|---|
| McCormick-Deering 22/36 H. P.<br>John Deere 15/27<br>Marshall 15/30 | Sind | Both in irrigated and unirrigated lands, in cultivated and uncultivated sections. |
| McCormick-Deering 22/36<br>McCormick-Deering 15/30<br>Lanz (two units) 15/27<br>Mercedes Benz 13/23<br>Caterpillar 30 | Dharwar District. | Light, medium and heavy black cotton soil.<br>Light and medium red lands. |
| Lanz (6 units) 15/27<br>McCormick-Deering 15/30 | Raichur | Medium black cotton soil. |
| Marshall 15/30 (new model) | Annigeri<br>Kundgol | Deep black cotton soil.<br>Same as at Annigeri but Annigeri soil retains moisture more than at Kundgol. |
| Hanomag 36 | Orai U. P. | Parwa—a light sandy soil.<br>Mar—gray/brown similar to the regur soil of southern India.<br>Kabar—similar to the deep black cotton soil of the Southern Division, Bombay. |

Full specifications of these tractors supplied by the agents are in Appendix B.

## Special features of tractors.

Every tractor has its own special features and whilst the following is an attempt to summarise these outstanding features it must be remembered that tractor designs are frequently changing and that there must always be a considerable scope for difference of opinions on such a subject; these outstanding features are the ones specially noted by Burmah-Shell supervisors in charge of the tractors employed on the experimental work described in this monograph, or that have otherwise come to their notice elsewhere.

### McCormick-Deering 22/36 wheel type tractor.

1. The totally enclosed *Governor controls* resulted in first-class Governor action and no adjustments or replacements were necessary during the first two seasons this tractor was worked.

2. The *Belt Pulley Attachment* with its own gear enables the machinery to be worked without the introduction of a loose pulley, since it is not necessary to stop the power unit to bring the belt to a standstill.

3. *Water Control Valve* in the water-by-pass enables the temperature of the water to be maintained evenly by day and night and this prevents dilution of the lubricating oil.

4. The *Power Unit*, clutch, gear box and final drive are each removeable as a separate unit, without having to remove any other section of the tractor. This is an important point and enables time to be saved during repairs.

5. The *Fenders* and *Platform* are strong and required no attention during the three seasons for which this tractor was worked.

6. An *adjustable Drawbar* was fitted and this assured good balance and first class steering control under every condition of ploughing. With this fitting the correct line of draft was obtained for all implements.

7. No attention was required for *ball bearings* fitted as the main bearings for the crankshaft and these were in first class condition at the end of the three seasons' work.

8. A *one piece main frame* is fitted and was of great assistance at the time of overhauling, as it was not necessary to divide the tractor to remove any parts.

9. The *bonnet* fitted over the power unit enables the tractor to work under trees without the risk of any part of the power unit being damaged.

### McCormick-Deering farmall tractor : 6/12-8/16-15/30.

This tractor has all the advantages of the 22/36 McCormick-Deering tractor except the water control valve, fenders, platform and bonnet. It has in addition the following outstanding features.

1. 7 ft. turning radius which enables it to work in the corners of fields.
2. High clearance which enables it to work in standing crops.
3. Front wheels close together, which enable it to work between rows of standing crops for intercultivation.
4. The tractor is so designed that intercultivation implements can be fitted in front of the tractor in such a way as always to be visible to the driver.

### McCormick-Deering tractor T.20.

This tractor has all the advantages of the 22/36 McCormick-Deering tractor and in addition the following outstanding features :—

1. No *water injector*.

2. The *main clutch* and the two *steering clutches* are the same and this minimises the number of spare parts required to be kept in stock.

3. This tractor is the only tracktype tractor on the Indian market in which the power unit, clutches, and gear box can be removed as a unit without dismantling any other section of the tractor. This is of great value when carrying out repairs.

4. The *rocker arm bearings* are all lubricated by force feed which ensures perfect lubrication.

### Caterpillar 30/35.

1. No adjustment whatsoever was necessary to the track until the end of the second season and no adjustments were actually carried out during the three seasons' working. The work of this tractor can, therefore, be considered very satisfactory.

2. No replacements for the main or steering clutches were necessary until the end of the second season and no further replacements were necessary until the end of the third season.

3. A strong canopy is fitted as standard equipment. This is a point of considerable importance under Indian conditions.

4. At the end of three seasons' working the drawbar pull of the unit was 90 per cent. of the manufacturers' estimate for a new tractor. This is very good evidence of the reliable and satisfactory nature of the tractor generally.

5. The tractor was very well balanced under all soil conditions and with every type of implements.

### Marshall 15/30.

1. The fuel consumption was low.

2. The tractor was well balanced under all conditions.

3. There was good steering control under all conditions.

4. This tractor was the strongest of the single cylinder power units tested by Burmah-Shell.

### Hanomag diesel wheel type tractor 36.

1. This is a 4-stroke four cylinder full diesel tractor and a steady even power was obtained on the belt pulley and drawbar.

2. The *electric heating coils* enable easy starting and the average Indian farm-hand was able to start this tractor.

3. Strong serviceable *wheel scrapers* are fitted as standard equipment and ensure good traction under moist soil conditions.

4. An electric set is standard equipment and lights can be fitted both in front and behind as extra equipment.

5. The drawbar permits horizontal and vertical adjustment, thus enabling the correct line of draft to be obtained with all implements.

6. An *automatic slow return clutch lever spring* is fitted which eliminates fierce engaging of the clutch plates and sudden shock to the transmission is thus reduced.

### HANOMAG TRACK TYPE TRACTOR 50.

The *power unit* fitted to this tractor is the same as that fitted to the Wheel Type tractor and has therefore the same outstanding features.

### MERCEDES BENZ 13/23.

1. The *stroke* of the *fuel pump* is under complete governor control, which ensures the correct quantity of fuel being used under varying load conditions.
2. The unit is well balanced with *good steering control* and there was no excessive wheel slippage.
3. The *power unit* and *transmission chambers* are connected; one grade of oil is used for lubrication and signs of wear were found on the power unit or transmission after the season's close.
4. The fuel consumption was low.
5. The power unit being a four stroke the air is not drawn through the crankcase, which reduces the possible wear as a result of foreign bodies and dust passing through the air filter.

### JOHN DEERE 15/27.

1. All parts are easy to inspect and to remove.
2. There are fewer parts on this tractor than in most kerosene tractors.

### LANZ BULLDOG 15/27.

1. This tractor is easy to start when the hot bulb is fully heated, but care must be taken to see that the blow lamp is in good working order.
2. The fuel consumption was low when the tractor was worked at $\frac{3}{4}$ load.

### CASE 12/20.

1. The clutch is accessable and adjustable without removing any parts.
2. It was well balanced under moist soil conditions.

### THE POWER OF A TRACTOR.

Generally speaking, the power of a tractor advertised by the manufacturers is on the high side and an allowance of at least 30 per cent. should be made by purchasers in order to allow for conditions peculiar to certain districts such as for instance land situated at high elevation and also because no tractor can be expected to work at its maximum throughout. The demands and difficulties of salesmanship and competition possibly necessitates the tractor manufacturers advertising the power of their plant as the extreme maximum and although this procedure will probably never be changed it is an undesirable practice and one against which all purchasers of tractors and other units should be warned. In addition to the

manufacturers' figures of power, their figures of drawbar pull and other details are in most cases too high and cannot be justified in practice. It is a wise general rule, therefore, to allow a reserve power of 30 per cent. as already mentioned over the actual advertised power of the unit, and this is especially so in India in order to offset the harder conditions and the lower standard of maintenance the plant will receive. It must also be remembered that the advertised horse power for tractors is not the same for all countries and rather than state horse power it is suggested that manufacturers should mention how their tractors work under stated conditions with a definite implement (*e.g.*, medium black cotton soil) with a five furrow (or less) mouldboard plough and also the continuous drawbar pull of which the tractor is capable.

### Depreciation.

The life of a tractor naturally depends upon the work it carries out and upon the care it receives. The importance of regular lubrication, frequent overhauls and general careful supervision cannot be over emphasised and it is due to the failure to appreciate the importance of these points on the part of Indian tractor owners that there have been so many failures in the past. It is hoped that the following figures giving the working lives of various tractors employed on deep ploughing for weed eradication will be of some assistance in enabling tractor owners and purchasers to come to their own decision as to the correct basis of depreciation in their individual cases. The figures given below are only for actual ploughing hours (deep ploughing from 8″ to 11″ being carried out) and do not take into account the hours spent in transit, moving from site to site and the idle time when the engine may have been running but the unit not actually working. A fair basis of depreciation of tractors is a subject on which widely diverse views are expressed and at the Tractor Committee appointed in 1932 by the Advisory Board of the Imperial Council of Agricultural Research estimates of the useful life of a Kerosene-burning Tractor for deep ploughing varied from 1,000 to 6,000 working hours. The expenditure on spare parts must also be taken account of in considering this matter and as a general rule it can be said that when the spare part expenditure has equalled the initial cost of the tractor then the tractor is no longer economical to work. The expenditure on spare parts naturally increases with the life of a tractor and a statement will be found below giving such expenditure, season by season, for the various tractors engaged on deep ploughing work. From the statement now given the number of hours worked by each of the tractors employed by Burmah-Shell, together with details of fuel consumption and cost of spare parts for the whole of their actual working life will be found and it will be noticed that three tractors which worked the longest period, 2,686, 2,632 and 2,195 hours respectively, incurred expenditure on spare parts of Rs. 688, Rs. 1,570 and Rs. 311. The heavy expenditure on the second tractor of Rs. 1,570 was due to a new differential housing (Rs. 460) and rear axle (Rs. 160) having to be fitted as a result of an accident.

The following statement shows spare part expenditure for each of the tractors mentioned above.

| Tractor. | Hours worked (Ploughing time only). | Cost of spare parts for tractors. |
|---|---|---|
| | H. M. | Rs. A. P. |
| McCormick-Deering 15/30 | 1,247 15 | 374 9 11 |
| Lanz No. 1 | 886 50 | 354 7 5 |
| Lanz No. 2 | 2,686 40 | 688 8 5 |
| Lanz No. 3 | 2,632 35 | 1,570 1 10 |
| Lanz No. 4 | 2,195 25 | 311 5 11 |
| Lanz No. 5 | 1,488 10 | 537 13 6 |
| Lanz No. 6 | 1,566 10 | 591 8 6 |
| (*a*) Caterpillar (since been overhauled for road work)* | 1,164 15 | 72 3 3 |
| Mercedez Benz | 715 00 | 200 0 0 |
| McCormick-Deering 22/36 | 889 5 | 424 8 7 |
| McCormick-Deering 15/30 | 557 45 | 351 7 8 |
| John Deere | 1,196 30 | 1,290 4 7 |
| Marshall | 221 00 | 174 9 6 |

* Since the above was written this tractor has worked a further 1430½ hours on deep ploughing with a further spare part expenditure of Rs. 43-3-0.

## Fuel consumption.

Detailed statements of fuel consumption per acre and per hour are given in Chapters III, IV, V and VI dealing with the various ploughing projects, and also in the detailed costing statements which appear in Appendix A.

## Choice of a tractor.

*What is the Ideal Tractor for Indian Conditions?* This is an interesting question and one to which many varying replies will be given as every one will have their own ideas on particular points which a tractor should possess. In considering a subject of this nature, it must be remembered that big improvements are being made almost daily and what may appear ideal at the present time may be out of date in the very near future. Every manufactures is naturally out to give the public the best possible value for their money and all the reputable manufacturers are spending large sums on research and experimental work. The various types and sizes of tractors each offer certain advantages under given working conditions, and there is a good tractor for every different working condition. It is, therefore, up to the purchaser to assure himself that he has purchased the outfit most adapted for his particular type of work and he frequently overlooks the fact that some of the higher priced outfits offer far more than their extra purchase price in the form of fittings which are standard equipment and which on other tractors are extras. A cheap tractor is one which is cheap in operation and in order to be economical in operation it must be efficient.

The following points are given in the hope that they will assist the prospective purchaser of an outfit to decide what tractor will suit his own particular conditions best.

### Power.

The power of the tractor to be chosen depends upon the soil conditions of the land that is to be worked and the warning previously given, that an allowance of 30 per cent. over the advertised power and draw-bar pull figures should be allowed, must be borne in mind. If a sufficiently powerful outfit is not purchased there will be overloading, resulting frequently in a complete breakdown with the result that operations which have been carefully timed cannot be completed and there will be a considerable loss on this account. There is no point, however, in purchasing too powerful a tractor which will cost more and which on account of the higher interest, depreciation and other charges will increase the cost of operation. The details given in Chapters III, IV, V and VI dealing with practical ploughing schemes will be of further assistance to potential purchasers of tractors and will give them some idea as to the power required for different types of work.

*Fuel*: *Kerosene Oil or Heavy Diesel Oil.* Heavy Diesel oil is cheaper than kerosene oil in India, but it does not necessarily follow that this saving in the oil bill will automatically mean a saving in the cost of operation unless the tractor is kept efficient by regular overhauls. The question of fuel to be consumed is naturally of great importance and, generally speaking, on account of the large difference in cost between heavy diesel oil and kerosene oil the former is more likely to find favour in India. In addition the diesel tractor is simpler to operate and maintain, but its initial cost is usually higher than that of the kerosene tractor. A diesel tractor being fitted with slower speed engines than kerosene should for this reason have a longer life. The actual decision as to what tractor will be bought must be made by the purchaser after considering all the advantages and disadvantages on the various points, but if more than one outfit is purchased the make should be standardised.

### Wheel and Track-Type Tractors.

As in every other case there are good and inferior tractors of both Wheel Type and Track Types—each type in general has advantages over the other under given soil conditions for given operations. The advantages of each type can be summarised as follows :—

### Advantages of the Track-Type.

1. A greater pull at the drawbar is obtained from the same size of power unit on account of—
   (*a*) The lower gear ratio.
   (*b*) The greater ground bearing surface.

2. Small trenches and small steep banks can be crossed.
3. Soft sections, where a wheel tractor could not travel without extra equipment, can be crossed.
4. The turning radius is smaller.
5. The ground-bearing pressure is lower than on wheel type, which enables a track-type tractor to be used in any break in the rains when bullocks can be used. Driving trials at Nagpur showed that, provided the top film of the soil was dry, a track-type tractor could be worked sooner than bullocks—this makes a track tractor more suitable for work throughout the year.
6. Wheel slippage is reduced to a minimum. Greater drawbar pull can be obtained with the track-type tractor and although in the past the tracks have not had a long life or been very satisfactory there is no longer any question regarding the suitability of the tracks or of their economical life.

### Advantages of the Wheel Tractor.

1. Lower initial outlay for a given drawbar horse power.
2. Fewer working parts resulting in less wear.
3. Easier steering when ploughing as the furrow wheels run in the furrow.
4. The adjustment of the line of draft for ploughs, which can be done without side-draft, is easier.

### Spare Parts and After Sales Service.

The extreme importance of this point has already been stressed and unless adequate provisions are made under both these heads a tractor should never be purchased.

### Implements.

It is not always possible to obtain implements of the correct size for the tractors which it is contemplated to buy. This point is of great importance, because if an implement is too large for the power of the tractor, the tractor will be unable to give proper service through overload, whilst if the implement is too small it is impossible to get a full day's work at efficient rates out of the tractor.

It is not always advisable and possible to work on a high speed even if there is the necessary power to do so. Every prospective purchaser of a tractor should, therefore, satisfy himself, before deciding on the tractor, that the various implements which he will require for his type of work are available for use with the tractor, are of a suitable type and have been selected, tested and recommended by the firm who are selling the tractor. The choice of a suitable implement is of paramount importance as a tractor without agricultural implements is of no use to agriculture and this point of view is too frequently lost sight of by firms selling

tractors. The link between the tractor manufacturers and the agricultural implements manufacturers is still very weak and requires strengthening both in their own interests and that of the users of the tractors and implements.

### Demonstration before Purchase.

Unless a purchaser has considerable practical experience in tractors it is always advisable to arrange for the Tractor Agents to inspect the area where the tractor will work and to obtain their opinion as to the horse power required. Where it can be arranged, a practical demonstration on the actual area for a few days is eminently desirable and the purchase should be made subject to a successful demonstration.

*Intercultivation.* If this work is required a tractor with a high clearance and one which can work between the rows and has a small turning radius must be purchased.

### Mechanical features.

The following points regarding the mechanical side of a tractor to be purchased are suggested for consideration by purchasers.

*Air Cleaner.* An efficient air cleaner is of the utmost importance in India due to the dust on account of the hot dry weather during the ploughing seasons. An oil spray air cleaner has proved very efficient in India. It is recommended that two air cleaners be supplied with each tractor so that ample time may be given to the cleaning of the spare filter and so that the machine is not held up while this is being done.

*Balance.* The tractor must be well-balanced so as to assure steering control under all reasonable conditions.

*Brakes.* These should be large and strong permitting control for the driver when gears are being changed or in neutral. They should be so placed as to be within easy reach of the driver under all conditions.

*Clutch Driving.* Simplicity in design and facility in adjustment and removal are important.

*Crank Case Pan.* Facility in removal is important and one of pressed mild steel plate has the advantage of not cracking, if it is hit by a rock or tree-root.

*Cylinders.* Removeable sleeves or cast separately to permit better cooling and cheap replacements are suggested.

*Drawbar.* This should have both vertical and lateral adjustment.

*Exhaust.* These should be so placed as to keep the driver free from exhaust gases when working.

*Fenders.* These should be strong without being too heavy and should have good clearance to permit the trash or other obstacles which may at times hold on to the cleats, lugs or track plates to pass under the fenders without breaking them.

*Front Axle.* Springs to give the power unit support when working on uneven ground are of advantage and two coil springs which are frequently fitted, are recommended.

*Fuel Tanks.* Of large capacity fitted with good filters and a hand hole to permit cleaning are points to be noticed.

*Fuel Tank Caps.* A chain should be fitted to prevent loss, especially during night time.

*Fuel Pipes.* It is recommended that these should be of large diameter and very long in order to overcome shock.

*Governor.* Fully enclosed, sealed and the fuel should be under control—or the stroke of the pump in the case of diesel power units.

*Inspection Plates.* Large and strong inspection plates for the connecting rod main bearings are a great advantage.

*Lighting Set.* It may be necessary to carry out night work and a good electric set is recommended with both back and front lights.

*Nuts.* These should be of standard sizes with tools to fit; the fewer different sizes the better.

*Oil Filter.* This is essential as the life of the tractor or any power unit largely depends upon the condition of the lubrication.

*Oil Gauge.* Must be fitted and in a place where it can be seen from the driving seat at all times. In many tractors this is not the case.

*Platform.* This should be large and strong.

*Power Unit.* This must be fully enclosed and accessible and should be removeable as a unit.

*Seat.* Unless the driver is comfortable he cannot be expected to work for long hours or to give of his best. A comfortable seat is, therefore, of great importance together with adequate protection from the sun.

*Steering.* The chief points to be looked for in steering are that it should be large, strong, well lubricated and easy to handle.

*Steering Clutches.* These should be easy to adjust and remove.

*Spring Clutch Release.* The fitting of this enables the driver to remove his foot from the clutch pedal as soon as the gears have been engaged and the clutch pedal comes slowly back into place; in other words, the clutch plates are slowly engaged which overcome any sudden strain on the transmission, which otherwise might result through too fast release of the clutch pedal.

*Starting handles.* For single cylinder diesel oil tractors two starting handles should be fitted, as the average Indian driver is not as strong as the Western driver.

*Vision.* The vision both on the off and near side should be good and unobstructed.

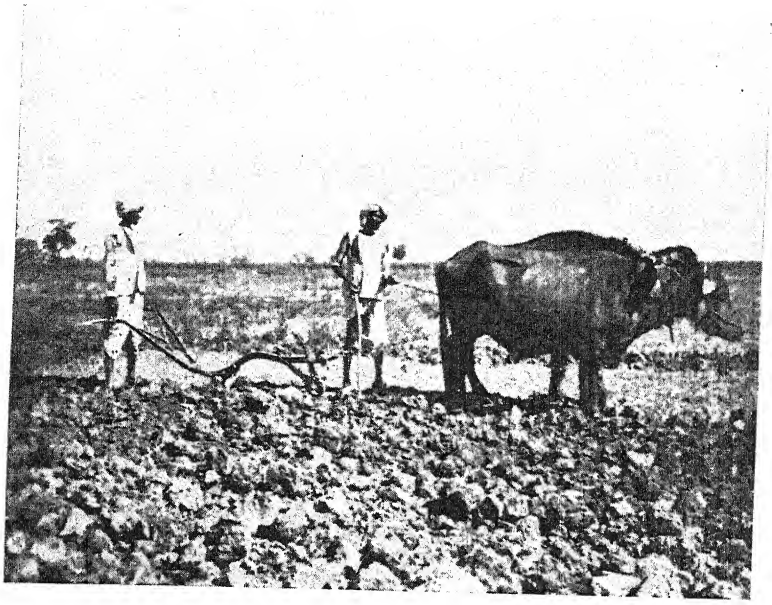
*Water Circulation.* Should be large in capacity with pump and fan.

## CHAPTER VIII.

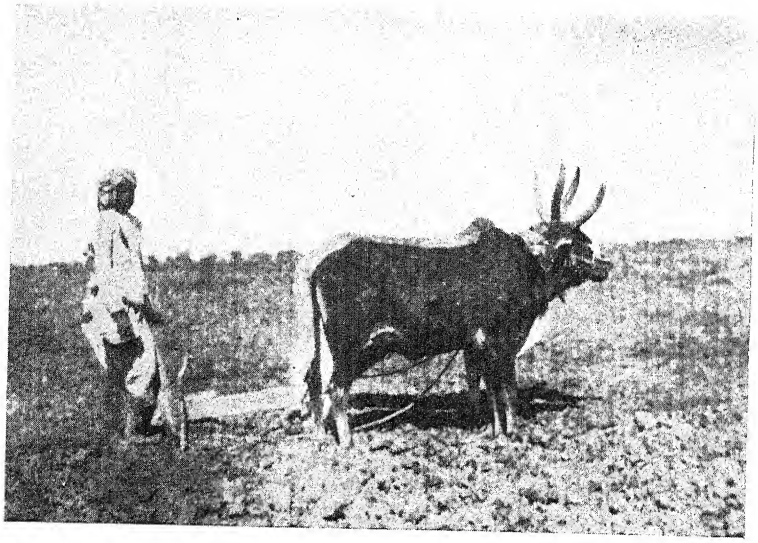
### PLOUGHS.

The strength and design of a plough must naturally depend very largely upon the power available to pull it and not only upon the resistance of the soil. The wooden plough was first designed for the only power which the agriculturist of the day then thought available, that is human power. The original wooden ploughs were pulled by slaves, who were eventually replaced by oxen and cattle. With the introduction of teams of cattle to pull ploughs it was necessary for the manufacturers to build ploughs which would stand the additional strain incurred by the introduction of the greater pulling power, and iron ploughs, multiple disc and mouldboard ploughs made their appearance. With the introduction of steam, agricultural engineers were able to make a yet further progressive step and steam ploughing outfits, both in the form of cable tackle and wheel tractors, made two new types of ploughs necessary. For the cable tackle outfit large drag line ploughs were manufactured and for the wheel tractor two, three and four furrow wheel ploughs were made to be attached directly to the power units by means of drawbars and chains.

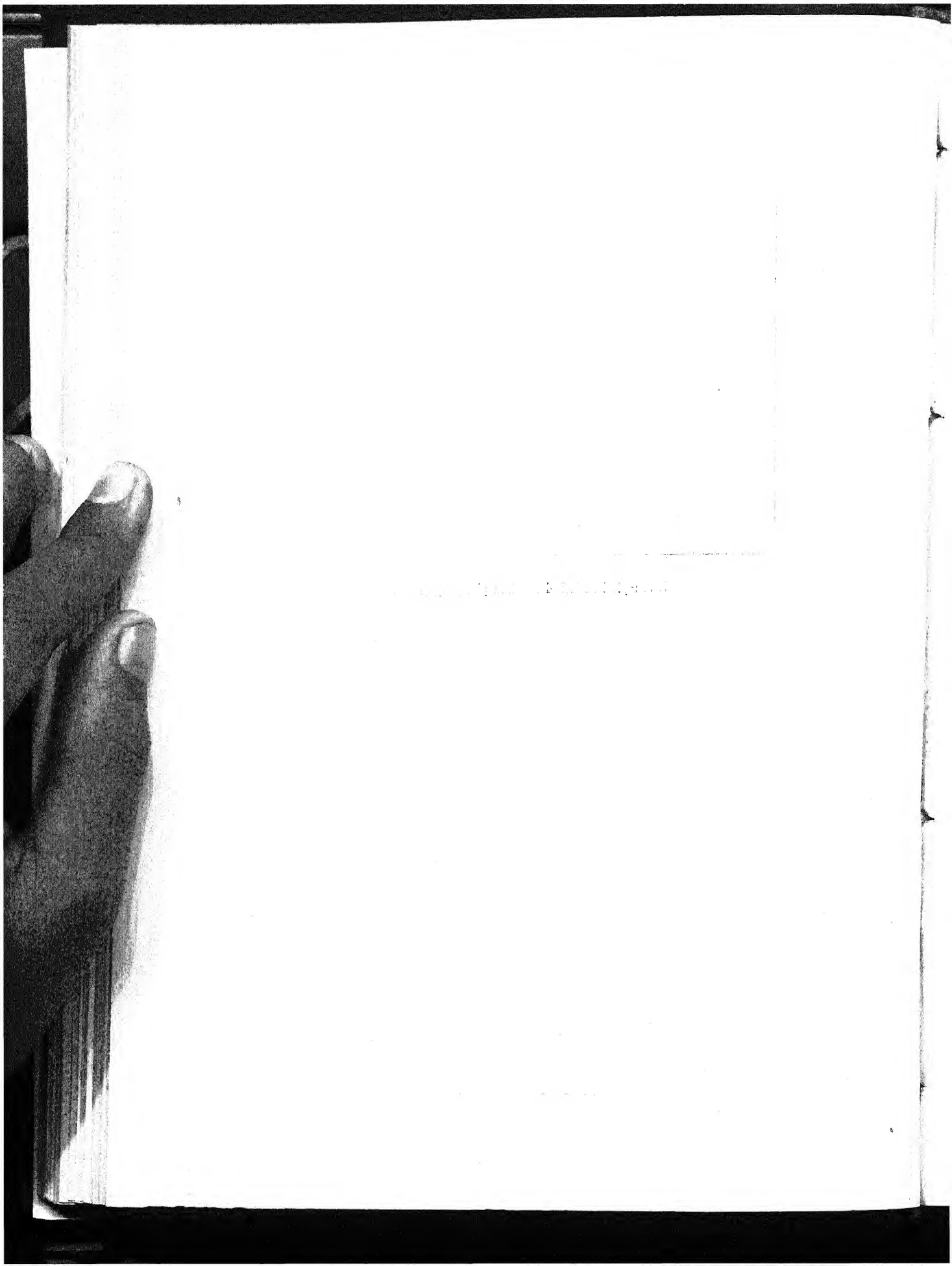
One of the results of the introduction of internal combustion petrol and kerosene oil engines has been to enable agricultural engineers greatly to improve the wheel type plough (which was actually invented before the internal combustion engine), with the result that at the present day it is possible to purchase ploughs which will work to different depths and which will work on hill-sides or on plains. The modern plough also has the great advantage of being able to be raised and lowered at the ends of the furrows by means of a clutch, which is worked by the tractor driver from his seat by pulling on the plough rope. It must be remembered, however, that ploughs have been built to meet the conditions in those countries where they are manufactured or where they are sold in large quantities and, therefore, they do not give at all times the same results in other countries, where the soil conditions differ and where too little investigation has been made into suitable types of ploughs. This is one of the reasons why, as already mentioned, the existing types of tractor ploughs now in use in India have not been able to plough satisfactorily below 10″. In order to ascertain the most suitable types of ploughs for a country like India it is essential for the plough manufacturers to send out experts to study the conditions on the spot and to decide for themselves what ploughs and implements can be used with the best results under the varying conditions found in this vast sub-continent. At the commencement of Burmah-Shell's experimental work ordinary P. & O. Mouldboard Ploughs with general purpose bottoms were used, but in order to enable better and deeper work 4″ extension pieces were welded on to the bottoms.



1. A typical bullock drawn iron plough (page 54).



2. A Wooden Plough (page 54).



A special large type Ransome's Disc Plough was also used but it is only under special conditions that this plough is suitable as is mentioned later. A Brush-Breaker Plough was also used but it is not economical and should only be used when the soil is very hard or the weed very thick and the question of price is not one of paramount importance.

### Disc ploughs.

It has just been mentioned that this plough can only be used in special circumstances. This type of plough has the following advantages over the Mouldboard Plough.

(*a*) Due to the small cut of each disc, a better seed bed, resulting in fewer air pockets, is left, and this results in better crops in the event of low rainfall.

(*b*) The disc cuts the soil into smaller sections, and in the case of weed infested land, the smaller section is better as more sun and heat is required to kill off the roots if the sections are large.

(*c*) A Disc Plough leaves an even seed bed on level land and the land is therefore more easily worked by bullock power than in the case of land ploughed by a mouldboard plough. This point, however, is of no great importance as it has been already stated that all operations, to ensure real economy, should be carried out by power.

### Mouldboard ploughs.

A Mouldboard Plough, on the other hand, has the following advantages over a disc plough :—

(*a*) The roots are not cut into small sections, as is the case when a disc plough is used, and therefore in cases where there is much moisture in the land or when rains follow soon after the ploughing, there is less chance of the weed returning.

(*b*) The mouldboard inverts the soil, whereas there is less inversion with the disc.

(*c*) Due to the furrow wheels being closer together than in the case of disc plough, more even depth of ploughing is obtained with a mouldboard plough on *uneven lands*.

(*d*) Due to the front furrow wheel and the rear furrow wheel being closer, better results are obtained on rolling lands.

Generally speaking, when the soil is in a very hard condition or very loose, it is impossible to work a disc plough, which is most suitable in the case of average light soils. As a result of the work carried out by Burmah-Shell, it was found in the conditions existing in those areas where the work was undertaken that a

mouldboard plough is unsuitable if the soil is very moist. Mouldboard ploughs have, however, been found to be perfectly suitable under different conditions elsewhere when the soil is very moist.

### Ploughing for weed eradication.

For grass eradication, one of the advantages of the mouldboard is that the soil is inverted and the grass is left on the surface, consequently it cannot take root again, since it is killed by the sun. It is, therefore, advisable not to plough close to the rains or when the land is in soft condition. Provided there is no moisture in the soil, the weed will die after ploughing by a mouldboard plough, which will leave the earth in large lumps.

After ploughing with a disc or mouldboard plough, it is advisable to pull a rake or Orchard Cultivator over the land in order to collect the weed, which can then be burnt.

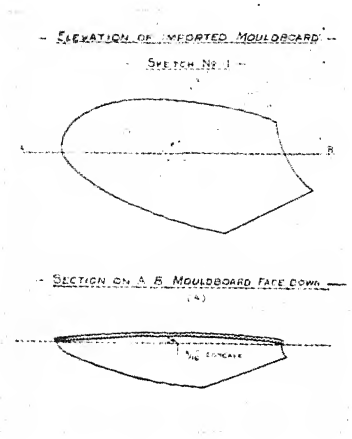
The use of the correct type of plough for the soil conditions and depth of ploughing required taken in conjunction with the power of the tractor to be used is more important than the actual power of the tractor, and many failures in the past have been due to wrong implements being used. Particular attention was, therefore, given by Burmah-Shell to the question of implements and in particular to the question of ploughs, and the outturn of work during the experiments has been naturally affected by the unsatisfactory nature of some ploughs.

The work a plough will do primarily depends upon the shares, disc or mouldboard and it is upon the efficiency of these parts that the success or otherwise of a plough depends. For deep ploughing the type of mouldboard ordinarily being imported into India and which is designed for a maximum ploughing of 10″ is not satisfactory for deeper work, as far too much soil is returned to the furrow, and this in turn results in the grass weeds being crushed back into the soil by the driving wheels of the wheel type tractor, and in the case of a track type tractor, the soil, which is returned to the furrow, causes the furrow wheel of the plough to ride and this results in the inner plough share not working so deep as the other bottoms. The soil is returned to the furrow on account of the angle of the mouldboard being too straight, which results in the soil breaking down too soon and passing under the wing of the mouldboard instead of passing over the end. The straight formation of the mouldboard also results in the soil meeting the mouldboard too squarely and this causes an increase of the draft. For work up to 9″ the ordinary imported type of plough is perfectly suitable.

### Deep ploughing in dry soils.

A type of mouldboard plough has been produced for ploughing 10″ and upwards, which will give better inversion and leave two clean furrows when working at a depth of 10″ to 14″ in dry soil. With this type of plough (two drawings of

PLATE VII.

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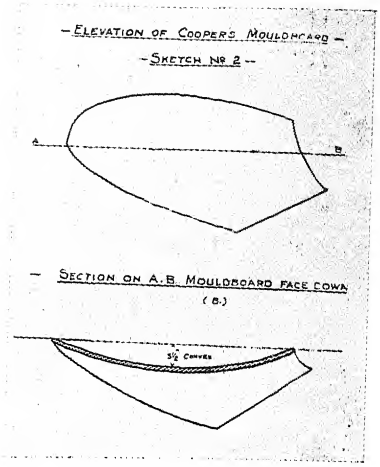


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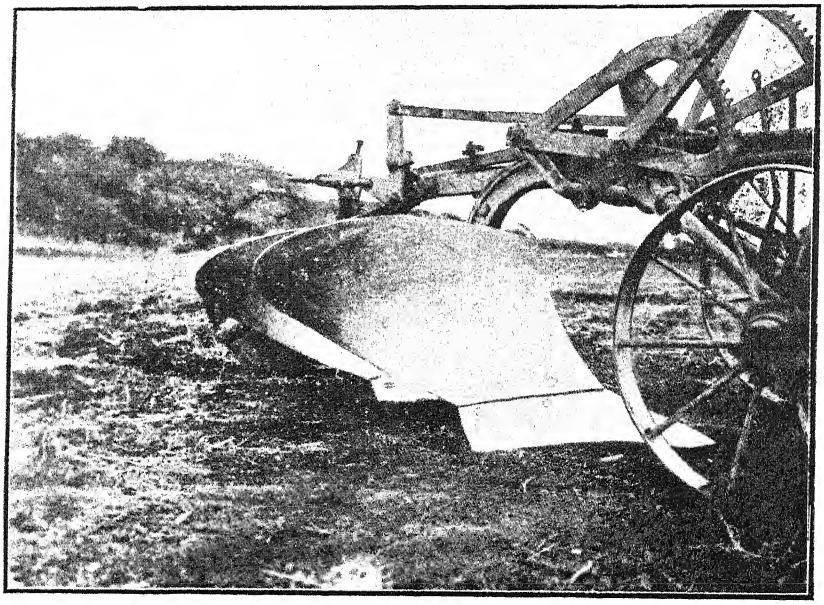


3.

Specially designed Mouldboard for ploughing upto 12″ deep manufactured by Cooper Engineering Works, Satara (page 57).

which are here given), there is every hope of increasing the output by 20 per cent., with a corresponding reduction in ploughing costs.

The general design of *imported* tractor mouldboards for ploughs is a bluff curve in the centre, and the centre line from the middle of the breast to the tail of the board shows a slight concavity as shown in sketch No. 1. (Pl. VII).

This concave seems to be the ideal for American soils, where different implements are used to suit varying soil conditions, and where ploughing is generally done under conditions of soil moisture, which create ideal soil adhesion by which a perfectly clean unbroken furrow slice can be cut and completely inverted, leaving a clean channel into which the next furrow can be perfectly laid. This same clean channel leaves a clear track for the furrow wheel of the plough, resulting in level consistent ploughing over the entire area of the field.

It has been definitely proved that the type of mouldboard which produces such ideal results under western conditions is of no use in the dry hard soils, which are prevalent in the principal regur and lateritic soil areas in India during the hot dry seasons of the year. These soils dry so hard that when they are being deeply ploughed huge clods are turned up by the plough and, owing to the concavity of the mouldboards, these clods are apt to stick in the centre, so that by the sheer pressure of the drawbar pull they roll along the face of the mouldboard and, instead of being turned over on the top of the last furrow slice, from 20 per cent. to 50 per cent. of them, roll back into the open furrow channel and seriously interfere with the furrow wheel of the plough on its next round thus making consistent ploughing impossible.

In the new design of mouldboard (Pl. VII) which was made by the Cooper Engineering Works, Satara, in conjunction with Burmah-Shell, the centre line from the breast to the tail was made convex—this convexity amounted to $3\frac{1}{2}''$ at the centre, as shown on sketch No. 2 (Pl. VII) and theoretically it is impossible for clods to stick, as they will either roll or slide along the convex plane ; since the tail end of the mouldboard has been "feathered" to about $5\frac{1}{2}''$, the clods should be thrown well over the previous furrow slice thus leaving a clean open channel for the next furrow slice and the furrow wheel of the plough. This ensures consistent ploughing in dry soils. Provision is also made for attaching extensions to the tail of the mouldboard, and these will further ensure forcing the clods clear of the open furrow.

### Deep ploughing in moist soils.

Having designed a mouldboard for dry soil ploughing, the question might arise as to how far this design will be suitable for soils containing a large percentage of moisture. The theoretical principles of ploughing and soil inversion from a western point of view have to be considered and anyone who is acquainted with ploughing in Europe and America knows that the ideal which a ploughman often aims at, whether he is using horses, tractors or steam cable tackle, is to leave a straight

razor edged, unbroken, crested furrow. When the mouldboard is made convex, the furrow slice is broken across in sections, and the greater the convexity, the more the furrow slice is broken up. The latter would appear to be the ideal for this country; the more the furrow slice is broken up or pulverised, the easier it will be for cultivation later on by the primitive tillage implements at the disposal of the Indian ryots.

The new design of mouldboards above described should have far less draft on the drawbar of the tractor, whether it is working in moist or dry soils. This can be readily understood when it is explained from a practical point of view. When the mouldboard shows a straight line from breast to tail, it is obvious that the furrow-slice bears a heavy pressure on the entire face of the mouldboard.

The new mouldboard being convex up to 6″ from the breast, the maximum pressure of the furrow-slice will be constant upto that distance, and after passing the zenith of the curve the furrow-slice will be theoretically sliding downhill with little or no friction.

The above design of plough with convex mouldboard appears to be the ideal for use in dry soils, but would not be suitable for moist or gummy soils, as the wetter soil would not scour (*i.e.*, would pile up on the mouldboard). The scope for the convex design must therefore be limited, as a plough that can be used in both dry and moist soils is one that would better meet general Indian requirements.

### Ploughing in dry and moist soils.

It has been remarked already that the type of mouldboard plough ordinarily imported into India (*i.e.*, the general purpose bottom) is entirely suitable for work upto 9″ under normal conditions and in dry, as well as in moist, soils. For work above 9″ in dry and moist soils involving deeper tillage than 9″, not only have the necessary changes to be made to the mouldboards and shares, but the plough in general must be re-designed. The following points require careful attention :—

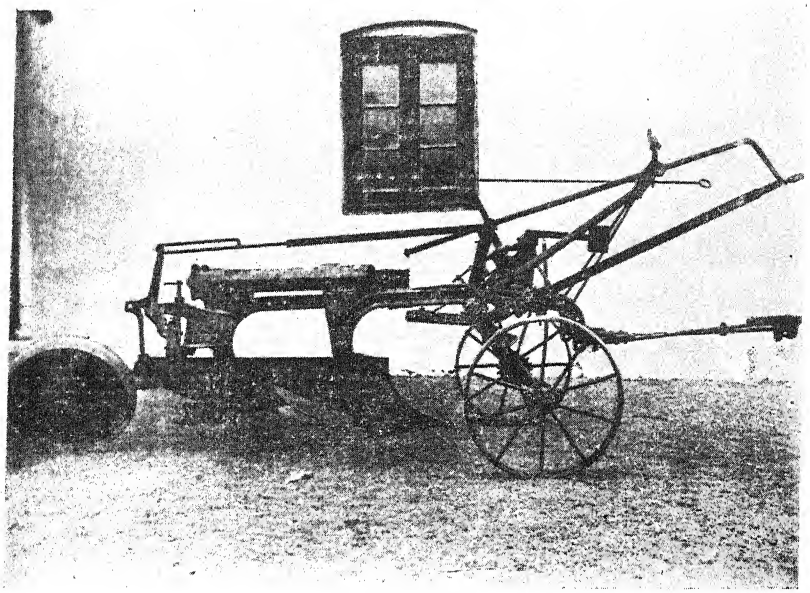
(1) The greater the depth the wider the cut, which not only necessitates the introduction of a wider share, but also results in the beams having to be placed further apart and larger and stronger beam braces being required.

(2) As more earth is passed along the mouldboards they have to be made much longer and less bluff to reduce resistance, and this results in a clean furrow being left. Mouldboard braces are very necessary.

(3) With extra earth passing between the first and second mouldboards the beams must be lengthened and their height increased.

(4) The increased height necessitates larger wheels, raising links and axles and the raising springs have to be larger and stronger, it being understood that the drawbar and release hitch have to be stronger in proportion.

PLATE VIII.



The Rud Sac Plough (page 59).

The undermentioned two new ploughs offer the following advantages :—

### Ransomes Ts-4.

This plough works successfully up to the average depth of 15″ and on account of the removable and adjustable bar point it is very light on plough shares, which are much cheaper to replace than the general All-Steel Share. Again the adjustable bar point permits more suck to be obtained in very hard soils, which is not possible with other types of shares.

### The Rud sac plough. (Pl. VIII).

This plough works very successfully up to 12″ and has the advantage of cheaper shares, when compared with the U. S. A. shares.

The mouldboards scour under very gummy soil conditions and are well braced. The beams are supported above by a very strong steel pipe to which steel plates are welded, and they support the whole bottom resulting in it being almost impossible to bend or twist a beam. All parts through the plough are strong and wherever it has been possible castings have been replaced with steel.

The following extract from a report made by Mr. T. R. Goslin of the Cockshutt Plow Company, Canada, who in 1933 visited India to study the agricultural implement market, is of interest and particularly his remarks about partial inversion for deep ploughing weed infested lands by means of a disc plough or Combine Tiller. Messrs. Marshall Sons & Co. (India), Ltd., Calcutta, agents for the Cockshutt Plough Company have kindly permitted the publication of these extracts from Mr. Goslin's report.

### Report on ploughing conditions in India.

" India, taken from a ploughing point of view, can be divided into two classes, (1) tractor ploughing, (2) bullock ploughing. Both of these vary considerably in different parts of India.

The advantage of tractor ploughing, apart from working costs, is very marked in India, two or even three crops being grown in one season. This means that the land has to be cultivated betwe n these crops and in the dry season,when this land is hard and dry, it can only be ploughed by tractor, whereas bullock ploughing has to be done immediately after the harvest before the land dries off, or after the rains.

The question of time also enters into the eradication of the *hariali*, *kans* grass, etc. These weeds have a horizontal root system 9″ to 12″ below the surface ; this requires deep ploughing during the dry season and bullocks are unable to supply the power necessary for complete inversion of the soil to this depth in this heavy soil. The choice of a plough depends on soil conditions and crops grown, as well as on the wishes of the customer. Soil conditions vary considerably even in the same districts so that the correct type of plough depends a good deal on actual trial.

Where the crop is of a broadcast nature, the semi-inversion plough (Tiller Combine) will be found most suitable and where a crop is such that complete inversion is necessary, choice lies between a mouldboard plough (Share Plough) or Disc Plough.

The ploughs are divided into various headings :—

(*a*) Complete inversion ploughs which are again subdivided into :—

1. Mouldboard Ploughs.
2. Disc Ploughs.

Complete inversion ploughs are used for breaking up new ground as well as for ordinary ploughing. Where complete inversion is necessary, as in the case of sugar-cane or cotton, any of these inversion ploughs can be used.

Complete inversion is not always necessary and it will be found considerably cheaper to use the semi-inversion (Tiller Combine) where such crops as wheat, rice, grass, *jowar*, etc., are seeded and broadcasted. This machine is capable of ploughing, cultivating and seeding in one operation.

Another condition enters into the scheme of things for India, and that is a deep plough for weed eradication of the *hariali* grass and the *kans* grass on the black cotton soils. This condition is ploughed during the dry weather when the soil is in a very hard condition. Complete inversion is necessary so that the roots of the weeds may be turned up and killed off by the sun. Owing to the depth at which this weed grows with its root system of from 9″ to 12″ below the surface and the hardness of the soil a strong plough is very necessary. The draft at this depth ranges between 2,000 to 3,000 lbs. per bottom."

## Plough shares.

Plough shares in general may be placed under five heads, namely :—

*Cast Chilled Shares.* They are far cheaper than the all-steel shares but will not stand up to stony or rocky lands. They can be re-sharpened by grinding.

*All-Steel Shares.* Have the advantage of being extra hard resulting in long life and may be re-sharpened and the point drawn by forging.

*Steel Soft Centre Shares.* These shares are built of three sections, the front and back being a glass hard steel and the centre a soft steel which takes up the shock when they meet stone, tree roots, etc. The points can be drawn and the cutting edge re-sharpened by forging.

*Bar Point Shares.* The main body of the share may be cast iron soft centre steel and solid steel and the standard point is replaced by a movable bar which is adjustable and may be re-sharpened times out of number. Again by adjusting the bar point greater suck may be obtained for hard soils. This type of share offers by far the most advantages and is very inexpensive.

*Removable Slip-on-Nose Point Shares.* This type of share is as a rule only made to fit cast iron shares. By having removable slip-on-nose points the life of the body of the share is lengthened as the most wear is on the point, which is replaceable at a small cost. This type of share has been very widely used for bullock ploughs.

During the experimental work described in this monograph solid steel, soft centre steel and cast iron chilled shares were used. During the first three seasons' work the expenditure on plough shares was very heavy, and it was apparent from the work carried out that there was room for considerable economies under this heading. The expenditure on plough shares for each outfit worked by Burmah-Shell for the first three seasons' work was as follows :—

*Cost of shares.*

| Outfit No. | Season. | Cost. | Acres. | Cost per acre. |
|---|---|---|---|---|
| | | Rs. A. P. | | Rs. A. P. |
| 1 | 1931-32 . . | 596 12 2 | 304·13 | 1 15 5 |
| 2 | 1931-32 . . | 28 14 5 | 32·75 | 0 14 1 |
| | 1932-33 . . | 130 0 10 | 117·14 | 1 1 9 |
| | Combined . . | 158 15 3 | 149·89 | 1 1 0 |
| 3 | 1932-33 . . | 132 6 6 | 100·0 | 1 5 2 |
| 4 | 1932-33 . . | 28 14 5 | .. | .. |
| 5 | 1931-32 . . | 61 8 9 | 760·22 | 0 1 4 |
| 6 | 1931-32 . . | 28 14 5 | 99·0 | 0 4 8 |
| 7 | 1931-32 . . | 260 0 9 | 303·65 | 0 13 8 |
| 8 | 1932-33 . . | 216 12 3 | 158·25 | 1 5 11 |
| 9 | 1931-32 . . | 229 7 3 | 341·9 | 0 10 8 |
| | 1932-33 . . | 280 8 3 | 224·12 | 1 4 0 |
| | Combined . . | 509 15 6 | 566·02 | 0 14 5 |
| 10 | 1931-32 . . | 198 13 9 | 320·65 | 0 9 11 |
| | 1932-33 . . | 447 15 5 | 226·7 | 1 15 7 |
| | Combined . . | 646 13 2 | 547·35 | 1 2 11 |
| 11 | 1931-32 . . | 214 2 6 | 340·95 | 0 10 11 |
| | 1932-33 . . | 216 12 2 | 100·17 | 2 2 7 |
| | Combined . . | 430 14 8 | 441·12 | 0 15 11¾ |
| 12 | 1931-32 (Dharwar) . | 176 11 1 | 144·29 | 1 3 7 |
| | 1931-32 (Raichur) . | 28 14 5 | 81·95 | 0 5 8 |
| | 1932-33 . . | 188 1 9 | 95·0 | 1 15 8 |
| | Combined . . | 393 11 3 | 221·24 | 1 12 6 |
| 13 | 1931-32 (Dharwar) . | 28 14 5 | 51·05 | 0 9 1 |
| | 1931-32 (Raichur) . | *nil* | 40·4 | .. |
| | 1932-33 . . | 185 5 0 | 211·52 | 0 14 0 |
| | Combined . . | 214 3 5 | 302·97 | 0 11 4 |

*N.B.*—Since the work referred to above was carried out, the prices of plough shares. have been reduced and the costs given above are on the high side.

During the experimental work carried out in 1933-1934 season an improved type of solid steel share was used and in tests carried out with three soft centre steel shares and three solid steel shares, the former were used for 58½ acres and worked for 146½ hours, whilst the latter were worked for 147 acres over 369 hours. In this particular test, as during the past seasons' work, the solid steel share gave far more efficient service than either the soft centre steel or the cast iron chilled shares.

The use of the improved type of solid steel share resulted in the cost per acre being reduced during the experimental work throughout the 1933-34 season to Re. 0-6-9½ per acre, against an average rate or acre for the seasons from 1931-33 of Re. 1-0-8·5 per acre.

## The Hitch and its Adjustment.

(With acknowledgments to McCormick-Deering Co.)

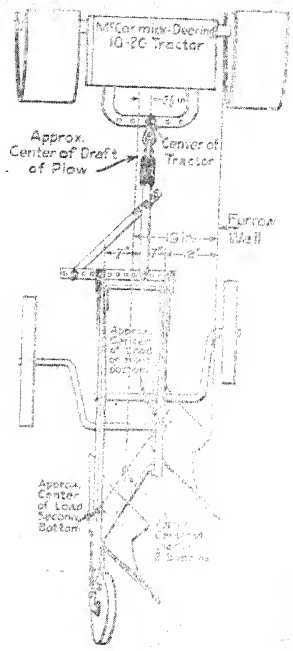
The hitch, in the sense it is here used, is the connection between the tractor and the implement it pulls. It starts from where flexibility begins at the rear of the tractor and ends where flexibility ends in the solid attachment to the implement, as is clearly illustrated. (Pl. IX).

*Centre of Resistance.* Every implement has a point where, if a single chain was attached the implement could be pulled straight ahead. This point is called " The Centre of Resistance ". Although most seed bed preparation implement have their centre of resistance in the centre of implement, this is not the case with ploughs.

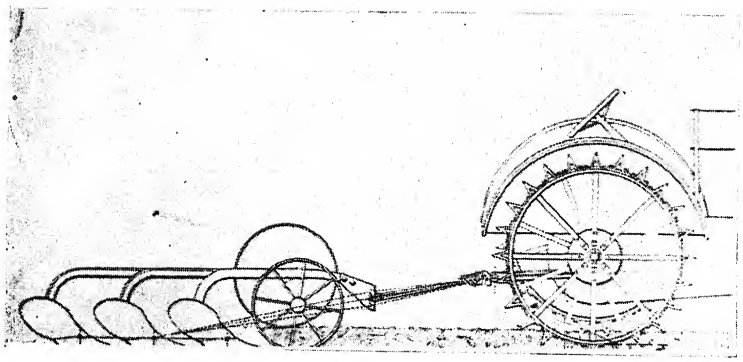
A mouldboard plough does not have its centre of resistance in the centre of the land worked. This point varies with most types of bottoms attached to the beams and also under different soil conditions and when ploughing is carried out at different depths. Most authorities agree that with a 12″ plough bottom, under average soil conditions and when working to a depth of 8″ to 10″, the centre of the load is about 2″ from the shim and not far from a point between the mouldboard and the share.

*The Centre of Resistance with a two-and three-Furrow Plough.*—Having completed the first round of ploughing, the second is started and masurements can be made from the wall of the previously made furrow. The point about 2″ from the shim, the centre of the load for the first bottom, is 10″ from the furrow wall. For the two furrow plough it is 10″ *plus* 12″, or 22″, from the furrow wall ; the centre of the load for this plough is therefore half way between 10″ and 22″, or 16″, from the furrow wall. In other words when a 12″ bottom is needed, the centre of the load shifts 6″ further from the wall of the furrow. Thus for a three furrow the centre of resistance is 22″ from the wall of the furrow. It must, however, be remembered that these locations are based more or less on the arbitrary assumption that the centre of the load is 2″ from the shim. In hard ploughing there is more pressure thrown on the mouldboards and the centre of resistance may move considerably towards the centre of the bottoms.

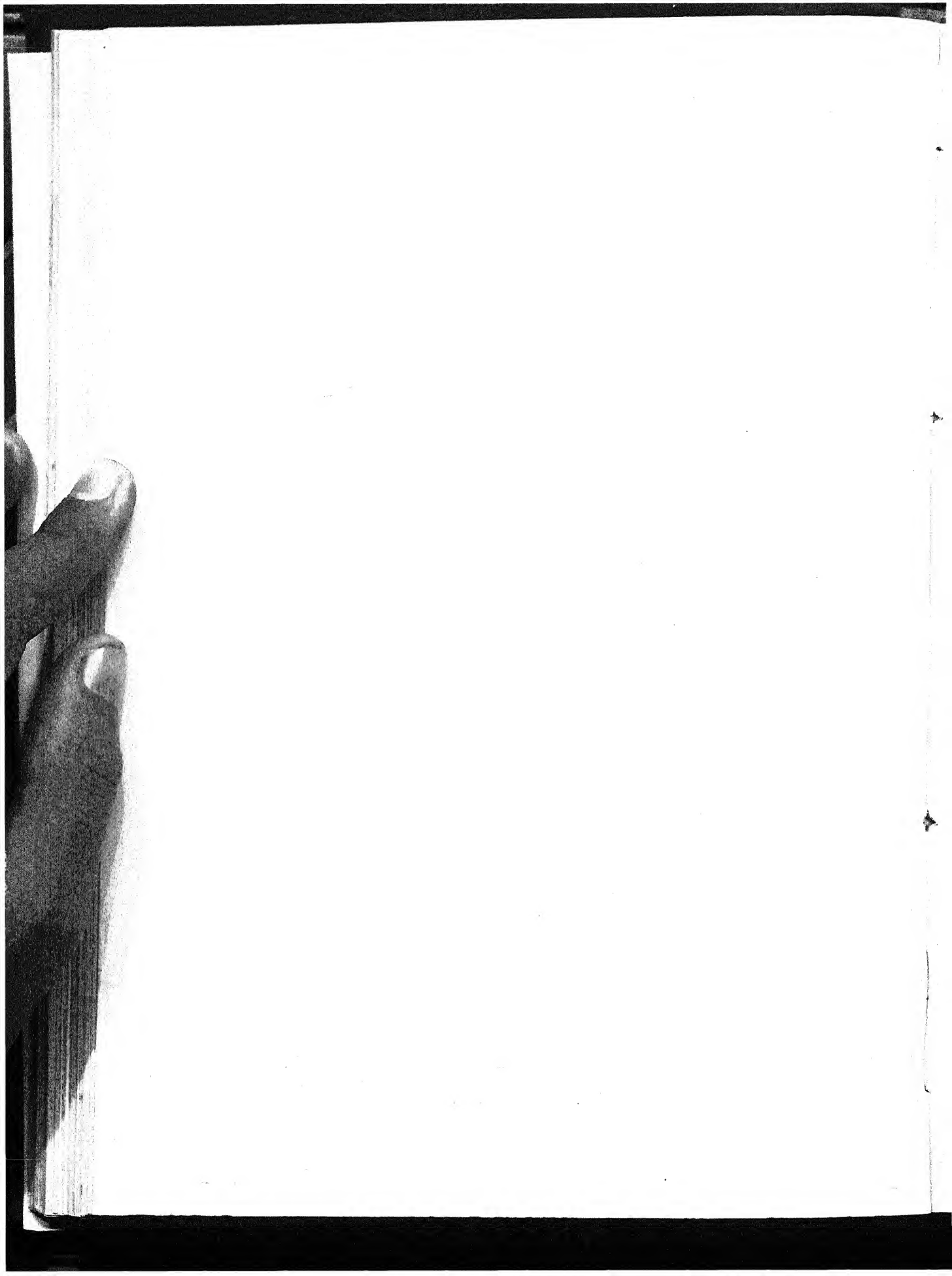
*N.B.*—We are indebted to Messrs. Volkart Bros., Agents for McCormick-Deering products for certain extracts from their literature regarding the Hitch.




1. The Hitch (page 62).



2. The Hitch (page 62).



*Line of Draft.* The line of draft is an imaginary line running from the point where flexibility starts at the tractor drawbar through the point where flexibility ends in the solid attachment of the implement to the centre of resistance. As the centre of resistance changes with different implements under different soil conditions, the line of draft must be checked from the side and above the tractor.

*Hitch too high.* If the hitch is too high, far too much weight will be carried on the front wheels of the plough ; this will result in worn bearings and a tendency for the bottoms to " stutter " or bob along on the point of the shares. This will, under many soil conditions, also result in poor scouring as with the bottoms running on the points of the shares the angle of the mouldboard is more abrupt which results in the soil encountering the turning surface of the mouldboard too squarely to permit it to be pushed off. Again on account of the mouldboard being too abrupt or too straight, the furrow slice breaks down before it should and passes under the wing and back into the new furrow.

*Hitch too Low.* Hitching too low on the plough has the opposite effect, for too much weight is carried by the rear wheel and the front wheels do not carry their proportion of the weight ; the result is that resistances, which should be converted into a rolling load, must be overcome as sliding friction causing a very much heavier draft.

*Watch the Land Wheel.* The best way to determine whether a plough is hitched correctly is to observe the land wheel. When this wheel runs straight it indicates proper lateral hitch adjustment.

*Side Draft.* When the line of draft is not hitched directly behind the centre of the tractor it results in side draft. With a wheel tractor this causes the front wheels to work towards or away from the ploughing and steering becomes almost impossible. With a track tractor the tractor tends to work to the right or left due to one track having to pull more load than the other. If the load is sufficiently heavy, the track pulling the greater load will have some slippage.

*Wheel Tractors and Side Draft.* As wheel tractors can be worked with one driving wheel in or out of the furrow side draft can always be overcome. Further when working with one driving wheel in the furrow, it is very often better to hitch a little to the left of the centre line of the tractor. The easiest way to check the position of the tractor clevis pin is to stand in front of a tractor when it is being worked. If the driver has to keep the front wheels towards the furrow wall this points out that the tractor tends to pull to the right, the clevis pin should be taken to the left of the centre line of the tractor. If the driver has to keep the front wheels towards the ploughed land, the clevis pin should be moved to the right to the centre line of the tractor.

*Side Draft and Track Tractors.* If the line of draft is further from the furrow wall than the centre line of the tractor, the tractor should be taken further from the

furrow wall. On the other hand, if the line of draft is closer to the furrow wall than it is possible to get the centre line of the tractor without pulling the left track in the furrow, the only possible way to reduce the side pull (after all possible off-set adjustments have been made) is to pin the drawbar of the tractor to one side and then lengthen the hitch which will reduce the angle of pull.

This, however, would only be necessary when ploughing very deep in hard dry soil. It should, however, also be remembered that when the hitch is lengthened the horizontal line of draft must again be checked ; most ploughs have the necessary adjustment to permit this, but should it not be possible to obtain the correct horizontal line of draft through the adjustment at the front end of the plough it can be obtained by adjustable tractor drawbar or in the case of a Caterpillar tractor by the use of the " Universal Drawbar ".

## CHAPTER IX.

## ORGANIZATION OF CONTRACT TRACTOR PLOUGHING.

In order to ensure the most efficient work and the best financial returns, the organization of a contract tractor ploughing scheme entails a considerable amount of preliminary work and detail. In considering the subject here it is assumed that the contractor will be receiving no direct support from Government through the Agricultural Department, such as assistance in canvassing or takavi loans. In many cases such assistance will be given and will naturally facilitate the organization and lessen the amount of detailed work. It is further assumed that a contractor wishes to start work with six tractors, *which will be used on deep ploughing for weed eradication only*, and all the statements contained herein are based on that assumption, unless it is specifically stated otherwise. The first and obvious step will, of course, be the selection of the area, in which the contractor should be entirely guided by the Agricultural Department of the area concerned, and by those with practical knowledge of tractor ploughing in India. Once the locality is decided upon, the area must be inspected by men with practical experience, and the depth of ploughing should be decided in order to enable a decision to be made as to the most suitable types of tractors, ploughs and other implements. Information which will assist contractors in deciding as to the types of implements and as to the depth of ploughing required, will be found in other parts of this monograph, but a warning must be given against ploughing too deep. It is the natural inclination of landholders, and also of many agricultural officers, to press for deeper ploughing than is actually required, and the important point must be borne in mind by the contractor in considering this matter that ploughing for weed eradication is not necessary at a lower depth than that at which the bottom rhizomes (the roots which regerminate) are found, except in the case of *kans* eradication when the rhizomes below 12″ do not regerminate. Having decided on the area, the depth of ploughing and the type of implements to be used, the contractor will naturally be able to fix the rate and the following is a draft budget of expenditure, based on six tractors, working on weed eradication to a depth of 10″, which will be of assistance to contractors in deciding upon the rates to be charged. It must be emphasized that these figures apply only to deep ploughing and if other work is carried out during the year all the overhead charges will naturally be reduced.

BUDGET EXPENDITURE FOR CONTRACT TRACTOR PLOUGHING BASED ON SIX DIESEL TRACTORS EMPLOYED ON DEEP PLOUGHING ONLY. DEPTH 10 INCHES.

| | Rs. A. P. | Rs. A. P. |
|---|---|---|
| 1. *Supervision*— | | |
| Supervisor's salary.—7 months full and 5 months half | 4,393 12 0 | |
| Assistant Supervisor.—6 months at Rs. 200 | 1,200 0 0 | |
| | | 5,593 12 0 |
| Canvassers.—3 at Rs. 60 a month. 1 for 12 months and 2 for 9 months | | 1,800 0 0 |
| 2. *Drivers*— | | |
| 6 at Rs. 50 for 5 months | 1,500 0 0 | |
| 13 at Rs. 35 for 5 months (inclusive of one blacksmith) | 2,275 0 0 | |
| | | 3,775 0 0 |
| 3. *Fuel and Lubricants*— | | |
| Fuel Oil for 3,800 acres at 5 gals. per acre at Rs. 3-12-6 per unit of 8 gals. | 8,980 7 6 | |
| Engine Oil for 3,800 acres at ·4 gal. per acre at Rs. 1-7-0 per gal. | 2,185 0 0 | |
| Transmission Oil for 3,800 acres at ·05 gal. per acre at Rs. 3 per gal. | 570 0 0 | |
| Grease for 3,800 acres at ·5 lb. per acre at Rs. 0-5-9 per lb. | 682 13 0 | |
| Waste for 3,800 acres at ·2 lb. per acre at Rs. 0-0-11 per lb. | 43 8 8 | |
| Kerosene Oil for 3,800 acres at 1/16 gal. per acre at Rs. 5-10 per unit of 8 gals. | 166 15 11 | |
| | | 12,628 13 1 |
| 4. *Transport : Main Road :* over a 40 mile lead— | | |
| Driver and cleaner 5 months at Rs. 30 and Rs. 8 | 190 0 0 | |
| Petrol 120 trips, 80 miles per round trip ; 9,600 miles at 15 miles per gal. 640 gals @ Rs. 1-8-6 per gal. | 980 0 0 | |
| Engine Oil 100 miles per gal. 9,600 miles and 96 gals. at Rs. 2-12-0 | 264 0 0 | |
| Spare parts, tyres, waste | 400 0 0 | |
| | | 1,834 0 0 |
| 5. *Spares and Repairs*— | | |
| Spares | 3,000 0 0 | |
| Plough Shares | 1,200 0 0 | |
| | | 4,200 0 0 |
| 6. *Camp Equipment* | | 400 0 0 |
| 7. *Railway expenses for Supervisor and Drivers* | | 200 0 0 |
| 8. *Interest and Depreciation*— | | |
| 6 Tractors @20% on Rs. 30,000 @Rs. 5,000 | 6,000 0 0 | |
| 6 Ploughs @12½% on Rs. 1,920 @Rs. 320 | 240 0 0 | |
| Interest on above 6 outfits at 6% on Rs. 31,920 | 1,915 3 2 | |
| Motor Truck @20% on Rs. 5,000 | 1,000 0 0 | |
| Interest on truck @6% | 300 0 0 | |
| | | 9,455 3 2 |
| 9. *Supervisor's allowance* | | 500 0 0 |
| 10. *Allowances for contingencies* | | 7,000 0 0 |
| | | 47,386 12 3 |
| Total acreage 3,800 for one season. Estimated cost per acre for 10″ work | | 12 7 6 |

EXPLANATION OF BUDGET.

1. *Supervision.* As only deep ploughing work for weed eradication is considered, the Supervisor is included at full pay for seven months to cover the actual ploughing period and a period for overhaul, and at half pay for the balance of the year. The Assistant Supervisor will only be required for the period of ploughing.

*Canvassers.* Three should be sufficient, but only one will be required for the full year and the other two for nine months, which allows a period before the ploughing season for the necessary canvassing.

2. *Drivers.* The ploughing season is taken as five months. Any staff required for overhauls after the ploughing season should be charged against contingencies. One senior driver and two juniors for each outfit are provided for.

3. *Fuel and Lubricants.* The figures are based on average actual consumption of six 15 H. P. Diesel Tractors employed by Burmah-Shell on 10″ ploughing for two complete seasons.

4. *Transport.* Under the usual agreement the landlords are responsible for transport of fuel, so this item should be considerably reduced as only transport for spare parts and stores will be on contractor's account. It is, however, thought advisable to include the maximum transport charges.

5. *Spares and Repairs.* Maximum figures have been included.

6. *Camp Equipment.*
7. *Railway Expenses.*
8. *Interest and Depreciation.*
9. *Supervision Allowance.*

} These call for no comment.

10. *Allowance for contingencies.* A large but necessary item in view of the uncertainty of the ploughing seasons, and of the various causes which may affect outturn, such as early rains and famine.

The rate having been fixed, the contractor will have to send out canvassers, whose duty it will be to obtain a sufficient area of land concentrated, so as to enable the tractors to work as close together as possible, in order to enable adequate and economic supervision by one man and a reduction in transport costs. Canvassers should first of all make friendly contact with the local Agricultural Officers, who can be of immense assistance in putting them in touch with landlords and tenants, who may require their lands ploughed. Unless Government are giving special takavi loans for the payment of the ploughing dues, the method of payment must be decided upon by the contractor and an advance of at least 50 per cent should be taken in all cases by the canvassers.

With six tractors it would be advisable to canvass for 750 acres a month, *i.e.*, 150 acres per tractor for five tractors, allowing for the sixth being kept as a reserve against breakdowns, accidents and other causes necessitating stoppage of work by any one tractor.

### Organization of work.

The main ploughing centre should be as near a rail head as possible so as to ensure a short lead for fuel and other supplies. The best arrangement is to have one main camp with the tractors working within a maximum radius of five miles, as these can be reasonably supervised by one man, subject to the driver of each outfit being held responsible for its condition. Major repairs should be carried out at the main camp, but with each tractor or series of tractors working on the same fields a travelling repair box should be sent, so as to enable minor repairs to be carried out on the site. The following tools and equipment are those which it is suggested should be kept actually on the ploughing site.

### Equipment.

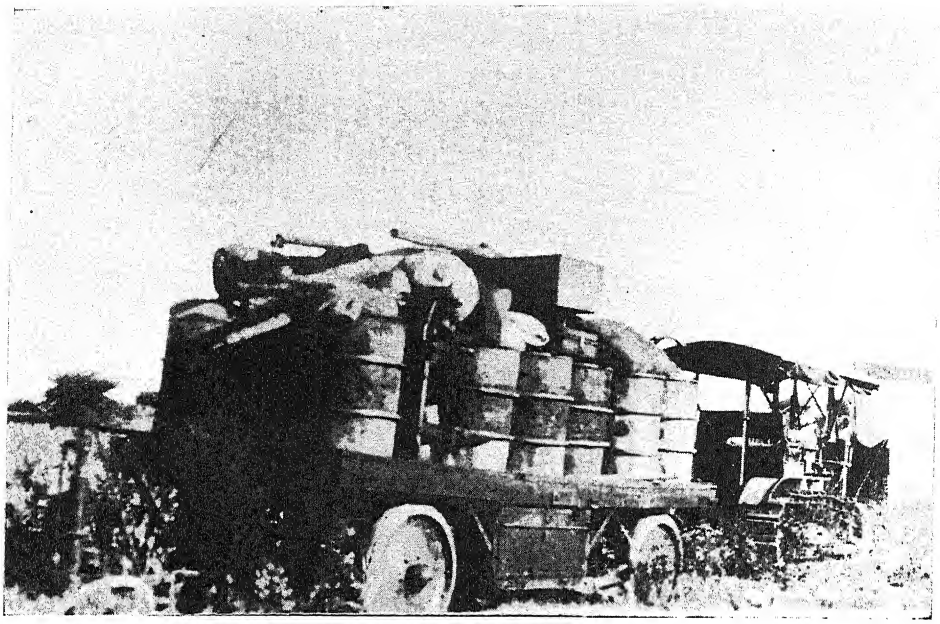
Camp and Office, 10 tents—
- 1 for Supervisor.
- 1 for Office.
- 1 for Assistant Supervisor and clerk.
- 7 for Drivers.

2 Petromax lamps.
10 Hurricane lamps.
2 Large tables
2 Small tables } All collapsible.
6 Chairs, collapsible.
1 Typewriter.
6 Watches for drivers.
1 Office clock.
2 Tin boxes for stationery and files.
2 Measuring tapes.
1 Letter scale.
1 Medicine chest.
15 Water casks (3 for drinking water).
1 Filter.
4 Tin boxes for small spare parts.
2 Racks (steel or wooden) for large spare parts.

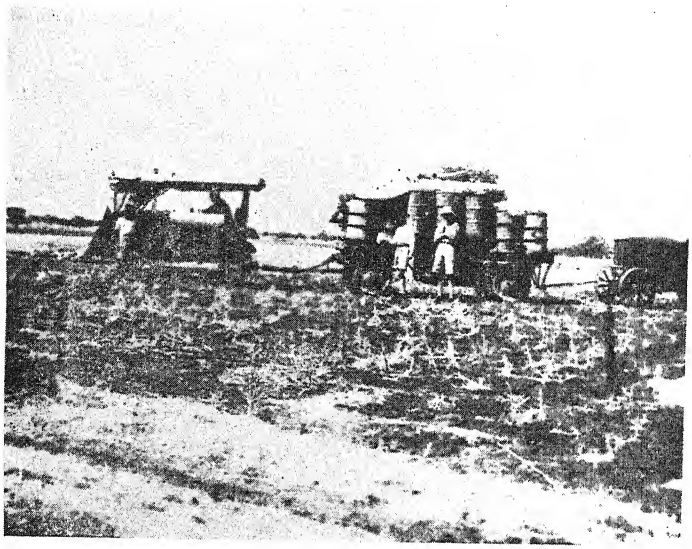
*Tools and Accessories—*

1 Set of tools to each tractor as supplied.
6 Funnels.
3 Measuring cans ($\frac{1}{2}$, 1, 2-gallon) for main camp.
30 Spare barrels (for Fuel).
1 Anvil.
1 Forge.
1 Set taps and dies.

PLATE X.



1. Moving Camp. Trailer loaded with stores and camp equipment (page 69).



2. Moving Camp. Trailer loaded with stores and camp equipment (page 69).

*Tools and Accessories*—contd.

1 Drilling machine.
1 Set blacksmith's tools.
3 Boxes of tractor spares (large).
1 Cycle for messages.
1 Spring balance.
1 Soldering set.
1 Emery grinding wheel.
1 Large Jack to lift tractor.
1 Standard Depth Measure.

### Programme of work.

The arrangement of the actual work is a matter of great importance and of considerable difficulty, as it is most important to ensure that the tractors travel as little as possible from field to field. When canvassing, the canvasser should mark on a map all the areas to be ploughed to enable the Supervisor to draw up his programme for each tractor and to ensure that they are not held up for want of work. During the actual ploughing season the canvasser should always work ahead of the tractors inspecting the fields next on the programme and see that the landlords have carried out their side of the agreement by clearing the fields and arranging for water supply.

*Staff.* An experienced Supervisor with mechanical and agricultural knowledge will be required together with an Assistant Supervisor, who will be responsible for a definite section of work to be delegated by the Supervisor, such as supervision of and responsibility for those tractors working at the greatest distance from the main camp. In view of the shortness of the season it is most advisable to work day and night; for this three drivers working eight hours each will be required. Electric lights for night work will be purchased with the tractors. A blacksmith and camp cooly should also be provided.

Since the work will in most cases be carried out in isolated areas, proper accommodation and arrangements for the staff are most important and particularly adequate arrangements for good drinking water. Normally the staff should be housed in tents, which will be pitched near the main camp, but if the tractors are working more than two miles from the main camp it may be advisable to have the drivers' tents pitched on the actual ploughing sites. One of the three drivers should be appointed Head Driver on a higher wage than the other two drivers and should be held responsible for the supervision and condition of one tractor outfit. As far as possible the drivers for each unit should be of the same community or caste as this facilitates commissariat arrangements.

In addition to the Supervisors and drivers it will be necessary to employ at least one clerk, who will be responsible for measuring up the lands on the conclusion of

work and for obtaining a certificate from the landlord that the work has been done satisfactorily. In addition, the clerk should be held responsible to the Supervisor for the collection of all balances due against work carried out and certified by landlords. In this connection a contractor would be well advised to come to some arrangements with the local agricultural authorities to act as arbitrators in the case of any dispute as to the depth of ploughing or as to the area ploughed.

### Fuel supplies.

Unless proper arrangements are made for adequate supplies of fuel, work will be held up. At least two weeks' maximum requirements should be held by the contractor in his main camp and arrangements to this end should be made with the supplying firm or agents. In order to ensure regular deliveries of fuel it will be advisable for the contractor to have a lorry, which will run from the nearest rail head to the main camp and can also be used for transport of fuel from the main camp to the ploughing site and for moving camp. Although landlords are responsible for the former under the agreement, it is not always possible to keep them to their agreement. At least one day's stock should be held with each tractor if working away from the main camp.

### Specimen Agreement between landlord and contractor.

A suggested form of agreement to be taken by the contractor from landlords or tenants is given below :—

An Agreement made between

(hereinafter called the Contractor) and

(hereinafter called the Landlord).

Whereas the Landlord has requested the Contractor to plough his land as set out below at the rates mentioned and whereas he has to this end paid Rs.
in cash, being equivalent to 50 per cent. of the estimated value of the work to be carried out, to the Contractor and promises to pay the balance on completion.

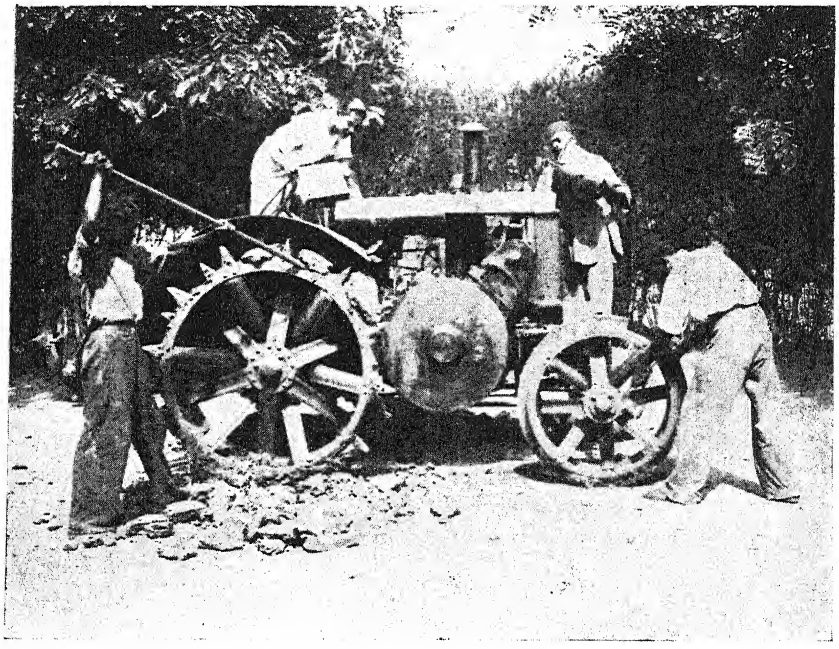
The Contractor agrees to do the work as set out in the schedule attached hereto.

The Landlord agrees :—

1. To have the land, as set out in the schedule hereto, tractor ploughed by the Contractor as herein more particularly mentioned.

2. To clean the land of all tree stumps, standing crops and roots and rocks which are above the surface.

3. To supply free of charge the necessary bullock carts or other transport to transport kerosene oil, crude oil, engine oil, etc., from the nearest railway station or oil depot to the site of ploughing and also to provide the necessary clear water required for the use of the ploughing outfits and for the staff employed therewith.



Refuelling on site of ploughing (page 70).

4. Not to hold the Contractor responsible for any loss which may be incurred by the landlord due to any breakdown of machinery before or during work or for any other cause outside the Contractor's control; in such cases to pay for the area ploughed.

5. To reserve to the Contractor the right to reject wholly or in part the contracted area as unfit for tractor ploughing by reason of it containing trees, stumps, stone, *nullahs* or land which is bound by waterways, hedges, fencing, standing plots or any other landlord's fields or lands.

It is mutually agreed that all disputes in regard to the depth of ploughing or the quality of work generally will be referred to the Deputy Director of Agriculture, whose decision will be final and binding.

*As Witness:*

SCHEDULE.

| No. of Acres. | Village. | Taluka. | Survey No. | Depth of ploughing. | Rate. |
|---|---|---|---|---|---|
| | | | | | |

If takavi is being provided the contract should stipulate that the landlord shall keep the land under steady cultivation where this is possible, as for instance, where *kharif* crops are grown during the monsoon.

The Agreement, it will be noted, provides for the landlord agreeing to supply water for the tractors and for the staff at the ploughing site and also for the landlord clearing the land of tree stumps, stones, rocks and other obstructions in order that the land may be ready for the tractor to start work immediately it arrives on the site. These are two most important points and must be fully explained by the canvasser before he concludes the agreement.

### Invoice.

*Invoice.*—On the measuring of land an invoice should be made out and submitted to the Landlord in the following form:—

Invoice No. ———— Dated the ————

Contract No. ———— Dated ————

DETAILS OF PLOUGHING WORK CARRIED OUT.

| Serial No. | Area. | | Depth in inches. | Rate. | Amount charged. | Advance. | Due. |
|---|---|---|---|---|---|---|---|
| | Acres. | Gunthas. | | | | | |
| | | | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |

Certified that the work mentioned above is satisfactory and the invoice is correct.

(Sd.) ———————— (Sd.) ————————

*Agricultural Inspector.* *Ploughing Contractor.*

Approval of the Cultivator :—

I am satisfied with the above work done for me and I agree to pay the amount of Rs.————————to Messrs.————————, being balance due on above work after deducting advance already paid.

————————

*Signature of the Landlord or Cultivator.*

STATEMENTS AND RECORDS TO BE KEPT BY SUPERVISOR AND CONTRACTOR.

In order that work may be carried out in the most economical manner, and in order that a close watch can be kept upon every side of expenditure, it is most important that a clear and fool-proof system of working costs should be maintained.

This system should enable the contractor to ascertain at a moment's notice the cost of each operation and at the same time the records should not take up too much of the Supervisor's time each day. The Supervisor should maintain in the field only those records required to permit the contractor's office to work out all the required costs and other data. The system set out below was used during the three years in which Burmah-Shell carried out practical tractor ploughing in different parts of India. It is hoped that this system will be of interest and value not only to potential tractor ploughing contractors, but to individual tractor owners. It will, however, require modifications according to the conditions under which contractors or individual tractor owners are working. It is assumed in discussing this system that the Supervisor will keep the necessary records on the field and that the final statements and final check will be made in the Contractor's office.

*Records to be maintained in the Field.*—The following should be maintained by the Supervisor in charge of ploughing operations.

## Driver's Daily Log Book.

Each outfit should be supplied with a log book which must be kept by the driver on each shift and which provides a check on area and on fuel consumption.

The following is a suggested form for the log book which has been filled in as an example :—

Date 1st June 1933.
Outfit : Number IV.
Contract No. 21.

| From. | To. | Hrs. | Work and reasons for stoppages. |
|---|---|---|---|
| 6 00 | 7 00 | 1 00 | Oiling and Greasing. |
| 7 00 | 14 00 | 7 00 | 10″ Ploughing. |
| 14 00 | 15 10 | 1 10 | Tractor breakdown. |
| 15 10 | 24 00 | 8 50 | 10″ Ploughing. |
| 24 00 | 24 30 | 0 30 | Plough breakdown. |
| 24 30 | 5 00 | 4 30 | 10″ Ploughing. |
| 5 00 | 6 00 | 1 00 | Transport 6 miles to Contract No. 22. |

Fuel : Kerosene oil.
First Dip. : 10.
Added : 14 *plus* 12.
Final Dip. : 6.
Total used : 30 gallons.

Engine oil : 2 gallons.
Transmission Oil : ¼ gallon.
Grease : 2 lbs.
Spare Part Nos. I. H. C. 2197 P. O. 1934.
Extras : 1 lb. cotton waste.

*Signature of Supervisor.*

**Indent Form.**

No.

Burmah-Shell Oil Storage and Distributing Co. of India Ltd.
Development Department.

Original.

To

_____

_____

Please supply $\frac{\text{to bearer}}{\text{by cart}}$ $\frac{\text{gallons}}{\text{lbs.}}$

in $\frac{\text{bulk}}{\text{tins}}$ of $\frac{}{\text{cans}}$

for the.....tractor outfit.

Dated.....

Supervisor.

Office use only:
Rate .....
Entered.....
NOTE.—Original to Agent/Depot supplying
Duplicate to supervising office with weekly statement.

No.

Burmah-Shell Oil Storage and Distributing Co. of India Ltd.
Development Department.

Duplicate.

To

_____

_____

Please supply $\frac{\text{to bearer}}{\text{by cart}}$ $\frac{\text{gallons}}{\text{lbs.}}$

in $\frac{\text{bulk}}{\text{tins}}$ of $\frac{}{\text{cans}}$

for the.....tractor outfit.

Dated.....

Supervisor.

Office use only.
Rate .....
Entered.....
NOTE.—Original to Agent/Depot supplying
Duplicate to supervising office with weekly statement.

This form will be prepared in duplicate by the Supervisor and one copy sent to the Office. It obviates any reference to the Spare Parts Stock Book. On receipt of the goods indented for, the suppliers' packing sheet will be checked against the indent before the account is passed for payment.

**Acknowledgment Form.**

Place ——————————————————

Date ——————————————————

The following has been received from Messrs.——————————————————

Number/Weight. Description.

(Sd.)

*Ploughing Supervisor.*

This form will be prepared in duplicate every time fresh stocks and supplies are received and is a formal check for the office against the suppliers' invoice before payment is made. One copy is sent to office and one retained by Supervisor.

## Daily Report Form.

Burmah-Shell (Development Department).

*Tractor Operation Daily Report.*

Tractor Place Date ——————————

Unit No. Implements

| From. | To. | Hours. | How time employed (*Depth of ploughing to be given*). | Contract No. | Kerosene oil. | Fuel oil. | Petrol. | Engine oil. | Grease. | Waste. | Transmission oil. | Acreage or mileage. | Spare parts. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Tractor. | Plough |
| | | | | | | | | | | | | | | |
| Total . | | | | | | | | | | | | | | |

Working hours laid down. Landlord's name. Drivers' Names.

Remarks

Date of posting Ploughing Supervisor.

These forms must be prepared in duplicate each day for each tractor from the drivers' log books already referred to. These will keep the Supervisor in touch with the condition of each tractor and implement. The fuel consumption can be checked and also, if the outturn is low due to the bad condition of the outfit or slackness in the working of the staff, it can be noticed. This report form is also the basic form from which the office obtain their final detailed working costs, as will be explained later.

## Weekly Fuel Stock Statement.

Camp.....

Outfits.....

Stock Book.

| Month | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Opening stock. | Received. | Used. | Stock. | Received. | Used. | Stock. | Received. | Used. | Stock. | Received. | Used. | Stock. | Received. | Used. | Stock. | Received. | Used. | Stock. | Received. | Used. | Closing stock. |
| Kerosene oil . | | | | | | | | | | | | | | | | | | | | | | |
| Crude oil . . | | | | | | | | | | | | | | | | | | | | | | |
| Petrol . . . | | | | | | | | | | | | | | | | | | | | | | |
| Engine oil . . | | | | | | | | | | | | | | | | | | | | | | |
| Transmission oil . | | | | | | | | | | | | | | | | | | | | | | |
| Grease . . | | | | | | | | | | | | | | | | | | | | | | |
| Waste . . . | | | | | | | | | | | | | | | | | | | | | | |
| Motor Lorry Engine oil. | | | | | | | | | | | | | | | | | | | | | | |
| Carbide . . | | | | | | | | | | | | | | | | | | | | | | |

This statement is sent weekly to the office but is prepared in duplicate daily by the Supervisor. It can be checked against the Acknowledgment Forms referred to above and also against the Daily Report Forms.

A check at any time is enabled by this statement.

## Cash Account Form.

Burmah-Shell (Development Department).

*Imprest Cash Account.* (*Petty Cash Disbursements for the period to of 193* ).

Ploughing Supervisor.

.....Ploughing Project.

Camp.....

Mech. Cult. Statement No. C.

ALLOCATION.

| Date. | Item. | Maintenance (Repairs). | | | | | Total. |
|---|---|---|---|---|---|---|---|
| | | General Account. | Tractor Unit No. | Tractor Unit No. | Tractor Unit No. | Tractor Unit No. | |
| | | Rs. A. P. | | | | | Rs. A. P. |
| | | | | | | | |

Consolidated *Bhatta* Allowance from———— to————

Summary.

Balance in hand on————19

Received from H. O. on————19 ————

Total . . . . . .

Less expenses as above . . . ————

Balance in hand on————19

————

*Signature.*

It is suggested that this form is submitted by the Supervisor to the office and all expenditure should where possible be allocated against a particular tractor or implement.

RECORDS TO BE MAINTAINED IN THE MAIN OFFICE.

Name. Tractor/Plough

Unit No.

Description of spare parts

Number of spare parts

**Spare Parts Stock Ledger.**

| Date 193 . | OPENING STOCK. | | RECEIPTS. | | | | | ISSUES. | | | CLOSING STOCK. | | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quantity. | Value. | Supplier's name. | Invoice No. | Rate. | Quantity. | Value. | Rate. | Quantity. | Value. | Quantity. | Value. | |
| | | Rs. A. P. | | | | | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | |

All spares received in accordance with the acknowledgments submitted by the Supervisor are entered in this book and all spares shown on the Daily Report Forms are also entered. This results in the daily stock of spare parts being on record both for the reference of the Supervisor and the Office.

Month Tractor Unit No.

## Time and Operation Report and Pay Roll.

| Date. | Contract No. | ACREAGE WORKED. OPERATION. Plough-ing 6″. | Plough-ing 9″. | Plough-ing 12″. | Mileage Transit. | TIME WORKED IN HOURS. OPERATION. Plough-ing 6″. | Plough-ing 9″. | Plough-ing 12″. | MAINTENANCE. Tractor. | Plough. | Transit. | General. | Total hours worked. | Work-ing hours laid down. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | |
| Totals . | | | | | | | | | | | | | | | |

*Monthly Pay Roll.*

| Name. | Desig-nation. | Rate per month. | Amount paid. | Total wages. Rate per hour. | Wages Allocation. |
|---|---|---|---|---|---|
| | | | Rs. A. P. | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |

Total monthly pay roll Rs.

This form is posted from the working hours given under each heading on the Daily Report Forms and the staff reported working on each particular outfit. This form is entered each day although it is a monthly form. This form is very important inasmuch as it enables a close contact to be maintained with the cost of labour for each operation and the value of labour lost due to the tractors being idle.

*Indented Material Expended Form.* (p. 83)

This form is also filled in from the Daily Report Forms and from the Cash Account Form. It gives the total monthly amount of material used and the value of fuel used for each and every operation.

Tractor Operating Statement. (p. 84)

This is compiled as follows and the information required against each item is obtained from the form mentioned against each operation.

*Labour.* Time and Operating Report Form.

*Fuel and Lubricants ; Materials and Spare Parts.* Indented Material Expended Form.

*Sundries.* Cash Account Form.

*Cost Summary Direct Charges ; Area Ploughed ; Working Time.* Time and Operating Report and Pay Roll Form.

*Cost per hour.* Dividing the total hours worked into total costs.

*Cost per acre.* Dividing the total area ploughed into total costs.

*Overhead Charges, Interest and Depreciation.* Will vary but 6 per cent. on the total value as interest is suggested. A given percentage per year or a depreciation for a given amount per working hour after the life of the tractor or implement over a given number of working hours has been fixed.

*Overhead Charges, Tractor Operator and Supervisor's Salary.* Time and Operating Report Form.

*Supervision/Other Expenses.* Cash Account Form and Office Accounts.

*Transit and General.* This item is brought up from the Transit and General Column in this Form.

*Final Cost Summary and Contractor Operator.* Totals are brought forward.

*Rate per hour.* Dividing the total hours worked into total cost.

*Rate per acre.* Dividing the total acres ploughed into total cost.

*Contract Register.* (p. 85)

In order to keep a record of all contracts, as well as of cash payments and work done, a Contract Register should be maintained in the office and separate entries will be made for each contract.

## Spare Parts.

The importance of an adequate and ready supply of spare parts for the tractor and ploughs will be obvious, but cannot be over-estimated. Failure to keep spare parts may mean the difference between loss and profit to a contractor on his season's working. The responsibility for this rests jointly with the tractor-plough agents who must keep adequate stocks of every part at main ports and at selected centres, up-country and on the tractor-plough owner, who should keep in the field all those spare parts, for which there is any reasonable possibility of being required; it is not, for example, necessary or advisable to keep a complete new frame in the field, although the agents should have this part as all others, ready for immediate despatch to any part of the country.

Much time was lost by Burmah-Shell due to the agents' failure to keep proper stocks of spare parts and this naturally resulted in increased costs per acre and decreased outturn.

As the names of parts for different tractors and ploughs vary largely, it is not possible or advisable to make definite recommendations regarding the spare parts that should be held in stock by tractor owners or contractors, who are advised to apply to the respective agents for this information.

Tractor Unit No.

| Month. | PETROL OR FUEL OIL. | | | | | | | | | KEROSENE. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Operation Account. | | | | | | | Transit account. | | Operation Account. | | | | | | | Maintenance account. | | Transit account. | | General account. | | | |
| | Ploughing 6″. | | | Ploughing 9″. | | Ploughing 12″. | | | | Ploughing 6″. | | | Ploughing 9″. | | Ploughing 12″. | | | | | | | | |
| Date. | Rate. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Rate. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | |

Burmah-Shell Ploughing Project. Mech. Cult. Statement No. B.

**Indented Material Expended Form.**

| ENGINE OIL. | | | | | | | | | TRANSMISSION OIL. | | | | | | | | | GREASE. | | | | | | | | | SPARE PARTS AND SUNDRIES. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operation Account. | | | | | | | Transit account. | | Operation Account. | | | | | | | Transit account. | | Operation Account. | | | | | | | Transit account. | | Maintenance account. | | | | | |
| Ploughing 6". | | | Ploughing 9". | | Ploughing 12". | | | | Ploughing 6". | | | Ploughing 9". | | Ploughing 12". | | | | Ploughing 6". | | | Ploughing 9". | | Ploughing 12". | | | | Tractor. | | | Plough. | | |
| Rate. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Rate. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Rate. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Part No. | Price | Rs. A. P. | Part No. | Price. | Rs. A. P. |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## TRACTOR OPERATING STATEMENT

*Period* *to*

| Tractor Unit No. / Location | Direct Charges. | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance cost.* | Total. | Acres ploughed or cultivated. | Time worked in hours. | Cost per hour. | Cost per acre. | Interest. | Depreciation. | Total. | Cost per hour. | Cost per acre. | Supervisors' salaries. | Supervision Other expense. |
| | Drivers' wages. | Petrol. | | Fuel or K. oil rate. | | Lubricating oil rate. | | Grease rate. | | Spare parts. | Repairs and sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | | | | | | | | | | | | | | | | | | | | | | | | |
| Operation — Ploughing 9" | | | | | | | | | | | | | | | | | | | | | | | | |
| Operation — Ploughing 12" | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance — Tractor | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance — Ploughs, etc. | | | | | | | | | | | | | | | | | | | | | | | | |
| Transit | | | | | | | | | | | | | | | | | | | | | | | | |
| General — Canvassing | | | | | | | | | | | | | | | | | | | | | | | | |
| General — Organisation | | | | | | | | | | | | | | | | | | | | | | | | |
| General — Transport, Camping and Idle Time. | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | | | | | | | | | |

Profit or Loss

| Tractor Unit No. / Location | Transit and general. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total. | Cost per hour. | Cost per acre. | Rate per Acre per hour. | Earnings. | Item. | Description. | Cost purchase Price. Rs. | Estimated life of..... hrs. | Depreciation at rate .....ant. per ann. or Rs..... per month. | Interest at Rate .....per ann. or Rs..... per month. | | | Fuel. | | | | Lubricating oil. | | Grease. | |
| | | | | | | | | | | | | | | | Kerosene. | | Fuel oil. | | | | | |
| | | | | | | | | | | | | | | | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | | | | | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | | | | | | | Tractor | | | | | | Remark | Ploughing 6" | | | | | | | | |
| Operation — Ploughing 9" | | | | | | | Ploughs or Implements. | | | | | | | Ploughing 9" | | | | | | | | |
| Operation — Ploughing 12" | | | | | | | | | | | | | | Ploughing 12" | | | | | | | | |
| Maintenance — Tractor | | | | | | | Total | | | | | | | | | | | | | | | |
| Maintenance — Ploughs, etc. | | | | | | | | | | | | | | | | | | | | | | |
| Transit | | | | | | | Camp | | | | | | | | | | | | | | | |
| General — Canvassing | | | | | | | Equipment | | | | | | | | | | | | | | | |
| General — Organisation | | | | | | | | | | | | | | | | | | | | | | |
| General — Transport, Camping and Idle Time. | | | | | | | | | | | | | | | | | | | | | | |
| Total | | | | | | | Share chargeable to General Account. | | | | | | | | | | | | | | | |

Profit or Loss

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of hours employed on each operation.

*Contract Register.*

| Serial No. | Date of application. | Contract No. | Name of applicant. | Taluka. | Village. | Survey No. | Acreage of survey. | Acreage to be ploughed. | Present crop. | Depth of ploughing. | Rate per acre. | Date of sanction of loan. / Cash advance. | Actual working of contracts. Started. | Completed. | Acreage. | Value. | Invoice No. and Date. | Date of payment. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Rs. A. P. | | | | | Rs. A. P. | | | |

# APPENDIX A.

## Tractor Operating Statistics.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Seasons 1930-31 and 1931-32.*

Period 20th March 1931 to 30th April 1931 and 15th September 1931 to 7th April 1932.

| Tractor Unit No. I. | | Direct Charges. | | | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | Labour. | Fuel—Lubricants. | | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| Caterpillar 30 H. P. | | Drivers' Wages. | Petrol. | | Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | | | |
| | | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation | Ploughing 6" | 16 12 8 | 3½ | 5 5 9 | 69·81 | 61 12 2 | 7·01 | 11 7 10 | 7·8 | 2 13 7 | | .. | 0 14 2 | .. | 99 2 2 | 27·84 | 29·5 | 3 7 6 | 3 9 0 | 20 15 3 | 37 10 7 | 157 12 0 | 5 6 9 | 5 10 8 | 7 9 6 | 36 14 6 |
| | Ploughing 10" | 33 4 10 | 15½ | 23 11 9 | 206·75 | 204 12 4 | 13·59 | 25 1 11 | 26·15 | 9 6 6 | | 22 13 3 | 12 13 6 | .. | 331 15 1 | 46·70 | 113·32 | 2 14 9 | 7 1 9 | 81 11 4 | 147 0 0 | 560 10 5 | 4 15 0 | 12 0 0 | 34 13 10 | 14 15 2 |
| | Ploughing 12" | 384 8 5 | 136½ | 284 13 0 | 2,423·16 | 1,819 8 1 | 169·96 | 308 15 3 | 128·2 | 46 11 0 | | 455 15 5 | 90 7 9 | .. | 3,390 15 8 | 366·87 | 1,021·38 | 3 5 1 | 9 3 10 | 735 6 2 | 1,323 0 8 | 5,449 6 6 | 5 5 4 | 14 13 8 | 263 2 1 | 473 14 7 |
| Maintenance | Tractor | 50 4 9 | 20⅜ | 45 12 9 | 59·0 | 39 2 1 | 22·0 | 42 2 0 | 12·5 | 4 7 10 | | 41 8 9 | 147 15 2 | .. | 371 5 4 | .. | 182·45 | .. | .. | .. | .. | 371 5 4 | .. | .. | 46 7 8 | 10 14 0 |
| | Ploughs, etc. | 42 3 7 | .. | .. | 10·0 | 6 13 0 | .. | .. | 10·0 | 3 9 0 | | 202 9 0 | 18 1 3 | .. | 273 4 4 | .. | 153·25 | .. | .. | .. | .. | 273 4 4 | .. | .. | 39 1 8 | 9 1 11 |
| Transit | | 54 9 0 | 44½ | 69 2 1 | 247·77 | 177 3 4 | 41·04 | 86 6 0 | 37·6 | 13 8 7 | | .. | 16 3 0 | .. | 417 0 0 | .. | 137·25 | .. | .. | .. | .. | 417 0 0 | .. | .. | 34 3 3 | 51 1 2 |
| General | Rains | 177 8 5 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | 75 15 11 | .. | 253 8 4 | .. | 645·0 | .. | .. | .. | .. | 253 8 4 | .. | .. | 163 13 7 | 38 5 4 |
| | No Spares, Land | 55 8 1 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | 23 12 2 | .. | 79 4 3 | .. | 201·40 | .. | .. | .. | .. | 79 4 3 | .. | .. | 51 3 8 | 11 15 10 |
| | General | 63 8 6 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | 27 3 2 | .. | 90 11 8 | .. | 230·50 | .. | .. | .. | .. | 90 11 8 | .. | .. | 58 10 5 | 13 11 7 |
| | Transport, Camping and Idle Time. | 111 3 4 | 155⅝ | 250 10 5 | 115·0 | 78 7 5 | .. | .. | .. | .. | | .. | 15 0 2 | .. | 455 5 4 | .. | 127·25 | .. | .. | .. | .. | 455 5 4 | .. | .. | 63 13 10 | 176 2 8 |
| | TOTAL | 989 7 7 | 435¼ | 679 7 9 | 3,211·50 | 2,387 11 2 | 254·50 | 474 1 0 | 222·25 | 80 9 0 | | 722 14 5 | 428 5 3 | [644 9 8] | 5,762 8 2 | 441·41 | 2,842·25 | .. | .. | 838 0 9 | 1,507 11 3 | 8,108 4 2 | .. | .. | 760 15 6 | 837 0 9 |

Profit or Loss.

| Tractor Unit No. I. | | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Percentage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | | | | | | | | | | | | | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Caterpillar 30 H. P. | | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of | Depreciation Rs. 1·295 per Hour. | Interest at Rate 6 per cent per Annum on the basis of 6 Ploughing months. | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hours. | Rs. A. P. | Rs. A. P. | | | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation | Ploughing 6" | .. | 202 4 0 | 6 15 3 | 7 2 3 | 11 0 0 | 306 4 0 | Tractor | Caterpillar 30 H. P. | 8,000 0 0 | 11 | 1,507 11 3 | 838 0 9 | Ploughing 6" | 29·5 | 1·02 | Ploughing 6" | 2·40 | 2·51 | ·12 | ·12 | ·24 | ·25 | ·26 | ·28 |
| | Ploughing 10" | .. | 610 7 5 | 5 6 0 | 13 1 2 | 15 0 0 | 700 0 0 | Ploughs or Implements | P. & O. No. 8 | 638 1 0 | | | | Ploughing 10" | 113·32 | 3·99 | Ploughing 10" | 2·61 | 6·36 | ·14 | ·33 | ·12 | ·29 | ·23 | ·56 |
| | Ploughing 12" | .. | 6,186 7 2 | 6 0 11 | 16 13 10 | 18 0 0 | 4,563 9 0 | | 3-Furrow P. & O. Disc. | 1,724 0 0 | | | | Ploughing 12" | 1,021·38 | 35·94 | Ploughing 12" | 2·37 | 6·69 | ·18 | ·51 | ·17 | ·46 | ·13 | ·35 |
| | | | | | | 20 0 0 | 2,266 12 0 | | 4-Furrow P. & O. Disc. | | | | | Maintenance Tractor. | 182·45 | 6·43 | | | | | | | | | | |
| Maintenance | Tractor | .. | 428 11 0 | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 153·25 | 5·40 | | | | | | | | | | |
| | Ploughs, etc. | .. | 321 7 11 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| Transit | | .. | 502 4 5 | .. | .. | .. | .. | TOTAL | .. | 10,362 1 0 | 8,000 | 1,507 11 3 | 838 0 9 | Transit | 137·25 | 4·83 | | | | | | | | | | |
| General | Rains | .. | 455 11 3 | .. | .. | .. | .. | | | | | | | Rains | 645·0 | 22·70 | | | | | | | | | | |
| | No Spares, Land | .. | 142 7 9 | .. | .. | .. | .. | | | | | | | No Spares, Land. | 201·40 | 7·09 | | | | | | | | | | |
| | General | .. | 163 1 8 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years | | | Camping | 127·25 | 4·48 | | | | | | | | | | |
| | Transport, Camping and Idle Time. | .. | 693 5 10 | .. | .. | .. | .. | | | | | | | General | 230·50 | 8·12 | | | | | | | | | | |
| | TOTAL | [1,956 14 11] | 9,706 4 5 | .. | .. | .. | 7,836 9 0 | Share chargeable to General Account. | | | | | | TOTAL | 2,842·45 | 100 | | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1930-31.*

Period 1st January 1931 to 30th April 1931.

| Tractor Unit No. II. | Direct Charges. | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | Labour. | Fuel—Lubricants. | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| Mercedes Benz. | Drivers' Wages. | Petrol. | | Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation . Ploughing 6" | 9 5 1 | .. | .. | 23·12 | 10 7 4 | 1·86 | 5 4 7 | 1·49 | 1 2 7 | .. | .. | .. | 26 3 7 | 12·0 | 21-13 | .. | 2 3 0 | 9 3 3 | 19 3 6 | 54 10 8 | .. | 4 8 1 | 6 11 5 | 15 6 4 |
| Operation . Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation . Ploughing 12" | 304 11 6 | .. | .. | 756·0 | 342 1 6 | 60·82 | 172 13 3 | 48·65 | 37 15 6 | .. | .. | .. | 857 9 9 | 267·10 | 693-47 | .. | 3 3 4 | 300 10 6 | 628 9 2 | 1,786 13 5 | .. | 6 11 0 | 219 8 3 | 502 7 0 |
| Maintenance . Tractor | .. | .. | .. | .. | .. | .. | .. | .. | .. | 304 7 0 | 160 1 2 | .. | 554 8 2 | .. | .. | .. | .. | .. | .. | 554 8 2 | .. | .. | .. | .. |
| Maintenance . Ploughs, etc. | | | | | | | | | | | | | | | | | | | | | | | | |
| Transit | 23 4 3 | .. | .. | 28·88 | 13 1 1 | 2·32 | 6 9 8 | 1·86 | 1 7 3 | .. | .. | .. | 44 6 3 | .. | .. | .. | .. | .. | .. | 44 6 3 | .. | .. | 16 12 4 | 28 7 5 |
| General . Canvassing | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General . Organisation | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General . Transport, Camping and Idle Time. | 412 4 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 412 4 2 | .. | .. | .. | .. | .. | .. | 412 4 2 | .. | .. | 297 0 0 | 681 2 2 |
| TOTAL | 749 9 0 | .. | .. | 808·0 | 365 9 11 | 65·0 | 184 11 6 | 52·0 | 40 9 4 | 304 7 0 | 160 1 2 | [554 8 2] | 1,894 15 11 | 270·10 | 768·0 | .. | .. | 309 13 9 | 647 12 8 | 2,852 10 4 | .. | .. | 540 0 0 | .. |

Profit or Loss.

| Tractor Unit No. II. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | Condition. | No. of Hours. | Percentage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of | Depreciation Rs. 900 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 Ploughing months. | | | | | Fuel | | | | Lubricating Oil. | | Grease. | |
| Mercedes Benz. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hours. | Rs. A. P. | Rs. A. P. | | | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation . Ploughing 6" | .. | 76 12 1 | .. | 0 6 4 | 9 0 0 | 108 0 0 | Tractor | Mercedes Benz | | | | | | | Ploughing 6" | .. | 1·927 | .. | .. | .. | ·125 | .. | ·121 |
| Operation . Ploughing 9" | .. | .. | .. | .. | .. | .. | | | | | | | | | Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation . Ploughing 12" | .. | 2,500 12 8 | .. | 0 6 3 | 12 0 0 | 3,207 0 0 | Ploughs or Implements. | 3-Furrow P. & O. | 7,250 0 0 | 8,000 | 647 12 8 | 309 13 9 | | | Ploughing 12" | .. | 2·829 | .. | .. | .. | ·228 | .. | ·124 |
| Maintenance . Tractor | .. | 554 8 2 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| Maintenance . Ploughs, etc. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| Transit | .. | 99 10 0 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| General . Canvassing | .. | .. | .. | .. | .. | .. | TOTAL | .. | 7,250 0 0 | 8,000 | 647 12 8 | 309 13 9 | | | | | | | | | | | | |
| General . Organisation | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| General . Transport, Camping and Idle Time. | .. | 1,390 6 4 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | .. | .. | | | | | | | | | | | | |
| TOTAL | .. | 4,631 1 3 | .. | .. | .. | 3,315 0 0 | Share chargeable to General Account. | | | | | | REMARK. | | | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1931-32.*

Period 13th December 1931 to 5th April 1932.

| Tractor Unit No. III. | Direct Charges. | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | | | | | | | |
| Lanz No. 1. | Drivers' Wages. | Petrol. | | Fuel or Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisions' Salaries. | Supervision, Other Expense. |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | 52 7 4 | .. | .. | 335½ | 158 11 1 | 17½ | 30 6 6 | 24½ | 8 12 10 | 132 8 9 | 33 7 9 | .. | 416 6 3 | | 69·37 | 249-30 | 1 10 9 | 5 14 4 | 101 12 6 | 292 7 4 | 720 10 1 | 2 14 3 | 10 4 11 | 59 8 6 | 13 15 1 |
| Operation—Ploughing 12" | 73 0 7 | .. | .. | 463½ | 218 13 5 | 53¼ | 94 4 3 | 47½ | 16 15 8 | 98 2 6 | 46 9 0 | .. | 547 13 5 | | 74·14½ | 347-35 | 1 9 3 | 7 5 10 | 141 11 0 | 282 4 2 | 971 12 7 | 2 12 9 | 13 1 1 | 82 15 9 | 19 6 10 |
| Maintenance—Tractor | 28 7 10 | .. | .. | .. | .. | .. | .. | 13 | 4 10 9 | .. | 18 3 0 | .. | 51 5 7 | | .. | 135-45 | .. | .. | .. | .. | 51 5 7 | .. | .. | 32 8 3 | 7 9 10 |
| Maintenance—Ploughs, etc. | 16 13 8 | .. | .. | .. | .. | .. | .. | 10 | 3 9 6 | 115 12 0 | 10 12 2 | .. | 145 15 4 | | .. | 80-15 | .. | .. | .. | .. | 145 15 4 | .. | .. | 10 2 10 | 4 7 10 |
| Transit | 14 13 8 | .. | .. | 98 | 46 5 1 | 16½ | 28 5 0 | 9 | 3 3 9 | 5 9 0 | 9 7 8 | .. | 107 12 2 | | .. | 70-45 | .. | .. | .. | .. | 107 12 2 | .. | .. | 16 13 11 | 3 15 3 |
| General—Rains | 29 6 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 12 5 | .. | 48 3 1 | | .. | 140-10 | .. | .. | .. | .. | 48 3 1 | .. | .. | 33 7 9 | 7 3 5 |
| General—No Spares, Land | 67 7 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 43 2 2 | .. | 110 10 0 | | .. | 321-50 | .. | .. | .. | .. | 110 10 0 | .. | .. | 76 12 11 | 17 15 10 |
| General—Transport, Camping | 6 13 1 | .. | .. | 63½ | 43 5 2 | .. | .. | .. | .. | .. | 4 5 7 | .. | 54 7 10 | | .. | 33-30 | .. | .. | .. | .. | 54 7 10 | .. | .. | 7 15 11 | 1 3 11 |
| General—Idle Time | 37 3 9 | 89 | 136 3 8 | 14¼ | 6 11 9 | .. | .. | .. | .. | .. | 23 12 4 | .. | 203 15 6 | | .. | 177-30 | .. | .. | .. | .. | 203 15 6 | .. | .. | 42 3 10 | 10 8 0 |
| Total | 326 10 5 | 89 | 136 3 8 | 975½ | 473 14 6 | 87¼ | 152 15 0 | 103¾ | 37 4 6 | 352 0 3 | 208 8 1 | [208 4 11] | 1,686 9 2 | | 144·11½ | 1,566-40 | .. | .. | 243 7 6 | 484 11 6 | 2,414 12 2 | .. | .. | 371 9 8 | 87 0 0 |

Profit or Loss.

| Tractor Unit No. III. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost, Purchase price. | Estimated Life of | Depreciation Rs. ·812 per Hour. | Interest at Rate 9 per cent. per Annum on the basis of 6 Ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 1. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hours. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 5,000 0 0 | 8,000 | 484 11 6 | 243 7 6 | Ploughing 10" | 249-20 | 16·62 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | .. | 704 1 8 | 3 3 6 | 11 5 9 | 15 0 0 | 1,048 14 0 | Ploughs or Implements | Ransome 2-Furrow 12" Bottom. | 857 14 0 | | | | Ploughing 12" | 347-35 | 23·33 | Ploughing 10" | .. | .. | 1·35 | 4·80 | ·07 | ·25 | ·09 | ·35 |
| Operation—Ploughing 12" | .. | 1,074 3 2 | 3 1 1 | 14 7 1 | 18 0 0 | 1,338 8 5 | | P. & O. No. 8 | 638 1 0 | | | | Maintenance Tractor. | 135-45 | 8·75 | Ploughing 12" | .. | .. | 1·33 | 6·24 | ·15 | ·72 | ·14 | ·63 |
| Maintenance—Tractor | .. | 91 7 8 | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 80-15 | 5·16 | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | 169 10 0 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| Transit | .. | 128 9 4 | .. | .. | .. | .. | Total | .. | 6,495 15 0 | 8,000 | 484 11 6 | 243 7 6 | Transit | 70-45 | 4·54 | | | | | | | | | |
| General—Rains | .. | 88 14 3 | .. | .. | .. | .. | | | | | | | Rains | 140-10 | 9·01 | | | | | | | | | |
| General—No Spares, Land | .. | 205 6 9 | .. | .. | .. | .. | | | | | | | No Spares, Land. | 321-50 | 20·67 | | | | | | | | | |
| General—Transport, Camping | .. | 64 5 8 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years | .. | .. | Camp Movement. | 33-30 | 2·15 | | | | | | | | | |
| General—Idle Time | .. | 256 11 4 | .. | .. | .. | .. | | | | | | | Idle Time | 177-30 | 11·37 | | | | | | | | | |
| Total | [743 15 4] | 2,873 5 10 | .. | .. | .. | 2,386 6 5 | Share chargeable to General Account. | | | | | | Total | 1,554-40 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1931-32.*

Period 13th December 1931 to 5th April 1932.

| Tractor Unit No. IV. | | Direct Charges. | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision. Other Expenses. |
| Lanz No. 2. | | Drivers' Wages. | Petrol. | | Fuel Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | Ploughing 10" | 35 9 5 | .. | .. | 301½ | 142 6 2 | 13½ | 22 14 9 | 22½ | 8 1 4 | .. | 21 12 0 | .. | 230 12 2 | 31·24 | 154-50 | 1 7 10 | 7 4 10 | 149 4 11 | 113 5 5 | 493 6 6 | 3 3 0 | 15 9 10 | 48 8 6 | 11 5 10 |
| | Ploughing 12" | 16 11 1 | .. | .. | 141½ | 115 6 4 | 3½ | 5 0 6 | 8½ | 3 0 10 | .. | 10 3 5 | .. | 150 6 2 | 19·18 | 72-45 | 2 1 1 | 7 13 5 | 70 3 11 | 53 4 1 | 273 14 2 | 3 12 3 | 14 1 4 | 22 13 1 | 5 5 6 |
| Maintenance | Tractor | 20 10 9 | .. | .. | .. | .. | 3 | 4 5 0 | 5 | 1 12 0 | .. | 12 10 5 | .. | 39 6 11 | .. | 90-0 | .. | .. | .. | .. | 39 6 11 | .. | .. | 28 3 1 | 6 9 8 |
| | Ploughs, etc. | 4 7 5 | .. | .. | .. | .. | .. | .. | 4½ | 1 8 5 | 115 12 0 | 2 10 0 | .. | 124 5 10 | .. | 19-45 | .. | .. | .. | .. | 124 5 10 | .. | .. | 6 3 4 | 1 7 3 |
| Transit | | 15 11 8 | .. | .. | 49½ | 20 10 10 | 3½ | 6 10 3 | 8 | 2 14 0 | .. | 9 10 0 | .. | 55 8 9 | .. | 68-30 | .. | .. | .. | .. | 55 8 9 | .. | .. | 21 7 8 | 5 0 5 |
| General | Rains | 29 7 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 0 8 | .. | 47 8 5 | .. | 128-15 | .. | .. | .. | .. | 47 8 5 | .. | .. | 40 3 4 | 9 6 8 |
| | General | 137 1 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 83 14 5 | .. | 221 0 2 | .. | 596-15 | .. | .. | .. | .. | 221 0 2 | .. | .. | 186 14 8 | 43 12 2 |
| | Camping | 7 9 2 | .. | .. | 63½ | 43 5 2 | .. | .. | .. | .. | .. | 4 10 6 | .. | 55 8 10 | .. | 33-0 | .. | .. | .. | .. | 55 8 10 | .. | .. | 10 5 4 | 2 6 8 |
| | Idle Time | 5 1 0 | 89 | 136 3 9 | 2½ | 1 2 11 | .. | .. | .. | .. | .. | 3 1 4 | .. | 145 9 0 | .. | 22-0 | .. | .. | .. | .. | 145 9 0 | .. | .. | 6 14 8 | 1 0 10 |
| | TOTAL | 272 6 0 | 89 | 136 3 9 | 552½ | 322 15 5 | 23 | 38 14 6 | 48½ | 17 5 4 | 115 12 0 | 166 0 3 | [163 12 0] | 1,070 2 3 | 51·2 | 1,185-20 | .. | .. | 219 8 10 | 166 9 6 | 1,456 4 7 | .. | .. | 371 9 8 | 87 0 0 |

Profit or Loss.

| Tractor Unit No. IV. | | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of | Depreciation Rs. ·732 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 Ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 2. | | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hours. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation | Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 5,000 0 0 | 8,000 | 166 9 6 | 219 8 10 | Ploughing 10" | 154-50 | 13·06 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| | Ploughing 10" | 553 4 10 | 3 9 2 | 17 8 2 | 15 0 0 | 474 0 0 | | | | | | | | Ploughing 12" | 72-45 | 6·14 | Ploughing 10" | .. | .. | 1·04 | 9·53 | ·08 | ·42 | ·15 | ·71 |
| | Ploughing 12" | 302 0 9 | 4 2 5 | 15 8 6 | 18 0 0 | 350 1 7 | | Ploughs or Implements. | Ransome 2-Furrow | 857 14 0 | | | | Maintenance Tractor. | 90-0 | 7·59 | Ploughing 12" | .. | .. | 1·04 | 7·27 | ·05 | ·18 | ·11 | ·44 |
| Maintenance | Tractor | 74 3 8 | .. | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 19-45 | 1·67 | | | | | | | | | |
| | Ploughs, etc. | 132 0 5 | .. | .. | .. | .. | .. | | | | | | | Transit | 68-30 | 5·78 | | | | | | | | | |
| Transit | | 82 0 10 | .. | .. | .. | .. | .. | TOTAL | .. | 5,857 14 0 | 8,000 | 166 9 6 | 219 8 10 | Rains | 128-15 | 10·82 | | | | | | | | | |
| General | Rains | 97 2 5 | .. | .. | .. | .. | .. | | | | | | | No Spares, Land. | 596-15 | 50·30 | | | | | | | | | |
| | General | 451 11 0 | .. | .. | .. | .. | .. | | | | | | | Camp Movement. | 33-0 | 2·78 | | | | | | | | | |
| | Camping | 68 4 10 | .. | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | .. | .. | Idle Time | 22-0 | 1·86 | | | | | | | | | |
| | Idle Time | 154 1 6 | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| | TOTAL | [353 4 7] | 1,914 14 3 | .. | .. | .. | 824 1 7 | Share chargeable to General Account. | | | | | | TOTAL | 1,185-20 | 100 | | | | | | | | | |

Profit or Loss

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation). Seasons 1931-32 and 1932-33.*

Period 11th February 1932 to 5th April 1932 and 1st January 1933 to 14th April 1933.

| Tractor Unit No. IV and I. | Direct Charges. | | | | | | | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | Labour. | | Fuel—Lubricants. | | | | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | | | | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | | | | | | | |
| McCormick-Deering 15/30. | Drivers' Wages. | | Petrol. | | Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease | Rate. | | | | Spare Parts. | Repairs and Sundries. | | | | | | | | | | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision. Other Expense. |
| | Rs. A. P. | | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | | | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | .. | | .. | .. | .. | .. | .. | .. | .. | .. | | | | .. | .. | .. | .. | | | | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | 151 | 6 1 | 40 | 63 11 4 | 1,315½ | 891 6 5 | 66 | 99 3 0 | 27 | 12 14 6 | | | | .. | 165 8 1 | .. | 1,294 1 5 | | | | 134·15½ | 507·45 | 2 9 1 | 9 10 0 | 258 4 0 | 348 13 2 | 1,901 2 7 | 3 11 11 | 14 2 4 | 271 14 11 | 50 15 8 |
| Operation — Ploughing 12" | 10 | 7 8 | 2½ | 3 7 1 | 61½ | 41 5 4 | 2 | 2 14 0 | 6 | 2 2 6 | | | | .. | 7 8 4 | .. | 67 12 11 | | | | 15·20 | 50·0 | 1 5 6 | 4 6 0 | 25 6 11 | 34 5 7 | 127 9 5 | 2 8 11 | 8 3 8 | 14 7 11 | 3 6 8 |
| Maintenance — Tractor | 21 | 5 6 | .. | .. | 9 | 5 7 8 | 28 | 53 7 6 | 18 | 6 1 6 | 351 | 7 | 8 | 9 | 3 0 | .. | 451 5 7 | | | | .. | 87·45 | .. | .. | .. | .. | 451 5 7 | .. | .. | 33 11 3 | 7 10 1 |
| Maintenance — Ploughs, etc. | 11 | 12 7 | .. | .. | 3 | 2 0 9 | .. | .. | 13 | 4 10 6 | 180 | 5 | 11 | 2 | 5 3 | .. | 196 14 3 | | | | .. | 41·45 | .. | .. | .. | .. | 196 14 3 | .. | .. | 20 5 9 | 3 14 5 |
| Transit | 15 | 0 4 | 10½ | 16 5 0 | 94 | 59 8 5 | 17 | 22 10 6 | 15 | 5 4 3 | .. | | | 4 | 7 2 | .. | 123 3 8 | | | | .. | 57·0 | .. | .. | .. | .. | 123 3 8 | .. | .. | 25 0 0 | 4 15 0 |
| General — Rains | 22 | 10 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | .. | .. | .. | 22 10 2 | | | | .. | 70·30 | .. | .. | .. | .. | 22 10 2 | .. | .. | 42 3 6 | 7 14 10 |
| General — No Spares, Land | 131 | 15 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | 40 | 15 7 | .. | 172 14 7 | | | | .. | 505·0 | .. | .. | .. | .. | 172 14 7 | .. | .. | 218 0 10 | 43 13 6 |
| General — Camping | 13 | 6 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | 3 | 2 8 | .. | 16 9 4 | | | | .. | 21·0 | .. | .. | .. | .. | 16 9 7 | .. | .. | 6 1 6 | 1 6·10 |
| General — Idle Time | 18 | 2 6 | 57½ | 89 9 11 | 47 | 30 8 8 | 9 | 14 1 0 | .. | .. | .. | | | 13 | 0 5 | .. | 165 6 6 | | | | .. | 115·0 | .. | .. | .. | .. | 165 6 6 | .. | .. | 41 10 3 | 8 2 0 |
| TOTAL | 396 | 2 6 | 110½ | 173 1 4 | 1,530 | 940 5 3 | 122 | 192 4 0 | 89 | 31 1 3 | 531 | 13 | 7 | 246 | 2 6 | [611 3 10] | 2,510 14 5 | | | | 147·35½ | 1,455·45 | .. | .. | 288 10 11 | 383 2 9 | 3,177 12 1 | .. | .. | 673 13 11 | 132 3 9 |

Profit or Loss.

| Tractor Unit No. IV and I. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost, Purchase price. | Estimated Life of— | Depreciation Rs ·687 per Hour. | Interest at Rate 6 per cent. per annum on the basis of 6 Ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| McCormick-Deering 15/30. | | | | | | | | | | | | | | | | | Kerosene. | | Petrol. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. | Hrs. | Rs. a. p. | Rs. a. p. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs | Lbs. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | | | | | | | Ploughing 10" | 507·45 | 34·88 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | .. | 2,224 1 2 | 4 6 1 | 16 8 9 | 15 0 0 | 2,015 13 0 | Tractor | McCormick-Deering 15/30. | 4,000 0 0 | 8,000 | 383 2 9 | 283 10 11 | Ploughing 12" | 50·0 | 3·43 | Ploughing 10" | 2·01 | 9·79 | ·08 | ·30 | ·15 | ·49 | ·07 | ·27 |
| Operation — Ploughing 12" | .. | 145 8 0 | 2 14 7 | 9 2 6 | 18 0 0 | 270 0 0 | Ploughs or Implements. | Ransome 2 Furrow. | 857 14 0 | | | | Maintenance Tractor. | 87·45 | 6·03 | Ploughing 12" | 1·23 | 3·97 | ·05 | ·15 | ·04 | ·13 | ·12 | ·39 |
| Maintenance — Tractor | .. | 492 10 11 | .. | .. | .. | .. | | P. & O. Mouldboard. | 638 1 0 | | | | Maintenance Plough. | 41·45 | 2·87 | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | 221 2 5 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| Transit | .. | 153 3 5 | .. | .. | .. | .. | TOTAL | .. | 5,495 15 0 | 8,000 | .. | .. | Transit | 57·0 | 3·92 | | | | | | | | | |
| General — Rains | .. | 72 12 6 | .. | .. | .. | .. | | | | | | | Rains | 70·30 | 4·85 | | | | | | | | | |
| General — No Spares, Land | .. | 435 2 11 | .. | .. | .. | .. | Camp Equipment. | .. | 500 | 2 years | | | No Spares, Land. | 505·0 | 34·69 | | | | | | | | | |
| General — Camping | .. | 15 1 8 | .. | .. | .. | .. | | | | | | | Camp Movement. | 21·0 | 1·44 | | | | | | | | | |
| General — Idle Time | .. | 224 2 9 | .. | .. | .. | .. | | | | | | | General | 115·0 | 7·89 | | | | | | | | | |
| TOTAL | [900 7 3] | 3,089 13 9 | .. | .. | .. | 2,294 13 0 | Share chargeable to General Account. | | | | | | TOTAL | 1,455·45 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1932-33.*

Period 28th January 1933 to 14th April 1933.

| Tractor Unit No. III. | Direct Charges. | | | | | | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | Labour. | Fuel—Lubricants. | | | | | | | | | Materials. | | | Total. | | | | | | | | | | | | | | | | |
| McCormick-Deering 22/36. | Drivers' Wages. | Petrol. | | Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | | Spare Parts. | Repairs and Sundries | Allocation Maintenance Cost.* | | | | | | | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | | | | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | | | | | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 9" | 8 13 0 | 3½ | 5 4 6 | 113 | 65 12 4 | 9½ | 14 13 6 | 10 | 3 7 0 | | .. | 23 2 5 | .. | 121 4 9 | | | | | | 17·11 | 48-0 | 2 8 5 | 7 0 4 | 16 2 5 | 29 2 2 | 166 9 4 | 3 7 6 | 9 10 3 | 20 10 4 | 3 12 0 | | |
| Operation — Ploughing 12" | 57 7 8 | 25½ | 40 0 6 | 749 | 435 15 1 | 17½ | 27 5 6 | 38 | 13 1 0 | | .. | 151 0 1 | .. | 724 13 10 | | | | | | 82·29 | 313-0 | 2 5 1 | 8 12 2 | 105 3 8 | 189 15 10 | 1,020 1 4 | 3 4 1 | 12 5 4 | 134 10 10 | 24 7 11 | | |
| Maintenance — Tractor | 5 13 10 | 4½ | 7 5 0 | 3 | 1 11 11 | 46 | 71 14 0 | .. | .. | | 37 6 9 | .. | .. | 124 3 6 | | | | | | .. | 32-0 | .. | .. | .. | .. | 124 3 6 | .. | .. | 13 12 3 | 2 8 0 | | |
| Maintenance — Ploughs, etc. | 5 13 10 | .. | .. | .. | .. | .. | .. | .. | .. | | 96 14 5 | .. | .. | 102 12 3 | | | | | | .. | 32-0 | .. | .. | .. | .. | 102 12 3 | .. | .. | 13 12 3 | 2 8 0 | | |
| Transit | 12 15 11 | 2 | 3 4 0 | 114 | 66 5 8 | .. | .. | .. | .. | | .. | .. | .. | 82 9 7 | | | | | | .. | 70-45 | .. | .. | .. | .. | 82 9 7 | .. | .. | 30 7 1 | 5 8 6 | | |
| General — Rains | 2 15 2 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 2 15 2 | | | | | | .. | 16-0 | .. | .. | .. | .. | 2 15 2 | .. | .. | 6 13 11 | 1 4 0 | | |
| General — No Spares, Land | 52 14 5 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 52 14 5 | | | | | | .. | 288-0 | .. | .. | .. | .. | 52 14 5 | .. | .. | 123 13 10 | 22 8 3 | | |
| General — Transport, camping and Idle Time. | 2 0 9 | 1½ | 13 4 6 | 30½ | 17 12 0 | .. | .. | .. | .. | | .. | .. | .. | 33 1 3 | | | | | | .. | 11-0 | .. | .. | .. | .. | 33 1 3 | .. | .. | 4 11 0 | 0 13 6 | | |
| TOTAL | 148 14 7 | 40½ | 60 2 6 | 1,009½ | 587 9 0 | 73 | 114 1 0 | 48 | 16 8 0 | | 134 5 2 | 174 2 6 | 226 15 9 | 1,244 10 9 | | | | | | 100·0 | 810-45 | .. | .. | 121 6 1 | 219 2 0 | 1,585 2 10 | .. | .. | 338 11 6 | 63 6 2 | | |

Profit or Loss

| Tractor Unit No. III. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dharwar. | | | | | | | | | | | | | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| McCormick-Deering 22/36. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of——. | Depreciation at Rate Amount per annum or Rs. per hour. | Interest at Rate 6 per cent. per annum on the basis of 6 Ploughing months. | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. | Hrs. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | McCormick-Deering 22/36. | 4,000 0 0 | 8,000 | 219 2 0 | 121 6 11 | Ploughing 10" | 48-0 | 6·02 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 9" | .. | 190 15 8 | 3 15 8 | 11 0 11 | 15 0 0 | 259 2 0 | | | | | | | Ploughing 12" | 313-0 | 39·02 | Ploughing 10" | 2·35 | 6·54 | ·07 | ·19 | ·20 | ·55 | ·21 | ·58 |
| Operation — Ploughing 12" | .. | 1,179 4 1 | 3 12 3 | 14 4 0 | 18 0 0 | 1,489 0 9 | Ploughs or Implements. | 2 Furrow Ransome. | 857 14 0 | | | | Maintenance Tractor. | 32-0 | 3·95 | Ploughing 12" | 2 39 | 5·05 | ·08 | ·38 | ·06 | ·21 | ·12 | ·46 |
| Maintenance — Tractor | .. | 140 7 9 | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 32-0 | 3·95 | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | 119 0 6 | .. | .. | .. | .. | TOTAL | .. | 4,857 14 0 | 8,000 | 219 2 0 | 121 6 11 | Transit | 70-45 | 8·73 | | | | | | | | | |
| Transit | .. | 11 8 2 | .. | .. | .. | .. | | | | | | | Rains | 16-0 | 1·97 | | | | | | | | | |
| General — Rains | .. | 11 1 1 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | | | No Spares, Land. | 288-0 | 35·52 | | | | | | | | | |
| General — No Spares, Land | .. | 199 4 6 | .. | .. | .. | .. | | | | | | | Camp Movement. | 11-0 | 1 34 | | | | | | | | | |
| General — Transport, Camping and Idle Time. | .. | 38 9 9 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| TOTAL | [367 8 6] | 1,997 4 6 | .. | .. | .. | 1,748 2 9 | Share chargeable to General Account | | | | | | TOTAL | 810-45 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1931-32.*

Period 11th December 1931 to 24th May 1932.

| Tractor Unit No. I. | Direct Charges. | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision Other Expense. |
| McCormick-Deering 15/30. | Drivers' Wages. | Petrol. | | Kerosene Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | 286 11 2 | 71½ | 109 7 9 | 1,821 | 1,280 6 4 | 115½ | 381 15 6 | 99½ | 35 10 8 | .. | 74 13 6 | .. | 2,169 0 11 | 303·26 | 1,247·5 | 1 11 10 | 7 2 3 | 246 1 0 | 707 3 0 | 3,122 4 11 | 2 8 0 | 10 4 6 | 395 5 10 | 25 7 1 |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | 63 12 9 | .. | .. | 2 | 1 6 6 | .. | .. | .. | .. | 374 9 11 | .. | .. | 439 13 2 | .. | 247·45 | .. | .. | .. | .. | 439 13 2 | .. | .. | 87 15 8 | 5 10 7 |
| Maintenance — Ploughs, etc. | 17 13 6 | .. | .. | 1 | 0 11 3 | .. | .. | .. | .. | 387 9 2 | .. | .. | 406 1 11 | .. | 77·15 | .. | .. | .. | .. | 406 1 11 | .. | .. | 24 0 10 | 1 9 4 |
| Transit | 29 4 5 | 8½ | 13 9 3 | 124½ | 87 11 9 | 27½ | 90 4 1 | 12 | 4 5 0 | .. | .. | .. | 225 2 6 | .. | 127·25 | .. | .. | .. | .. | 225 2 6 | .. | .. | 40 6 0 | 2 9 7 |
| General — Canvassing | 80 5 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 80 5 6 | .. | 349·30 | .. | .. | .. | .. | 80 5 6 | .. | .. | 110 12 10 | 7 2 1 |
| General — Organisation | 11 14 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 11 14 5 | .. | 51·45 | .. | .. | .. | .. | 11 14 5 | .. | .. | 16 4 11 | 1 0 11 |
| General — Transport, Camping and Idle Time. | 99 3 3 | .. | .. | 63½ | 44 10 5 | .. | .. | .. | .. | .. | .. | .. | 143 13 8 | .. | 431·35 | .. | .. | .. | .. | 143 13 8 | .. | .. | 126 14 5 | 8 12 11 |
| TOTAL | 589 1 0 | 80½ | 123 1 0 | 2,012½ | 1,414 14 3 | 143½ | 472 3 7 | 111½ | 39 15 8 | 762 3 1 | 74 13 6 | [845 15 1] | 3,476 4 1 | 303·26 | 2,502·30 | .. | .. | 246 1 0 | 707 3 0 | 4,429 8 1 | .. | .. | 812 5 6 | 52 4 6 |

Profit or Loss

| Tractor Unit No. I. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of ——. | Depreciation at Rate Amount per annum or Rs. per Hour. | Interest at Rate 6 per cent. per annum on the basis of 6 Ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| McCormick-Deering 15/30 | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. | Hrs. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | McCormick-Deering 15/30. | 4,160 0 0 | 8,000 | 707 3 0 | 246 1 0 | Ploughing 10" | 1,247·15 | 48·07 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | .. | 3,543 1 10 | 2 13 5 | 11 10 8 | 15 0 0 | 4,554 0 0 | Ploughs or Implements. | P. & O. Mouldboard No. 8. | 375 15 9 | | | | Maintenance Tractor. | 277·45 | 10·83 | Ploughing 10" | 1·46 | 5·09 | ·06 | ·23 | ·09 | ·38 | ·08 | ·32 |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 77·15 | 3·03 | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | .. | 533 7 5 | .. | .. | .. | .. | | | | | | | Transit | 127·25 | 4·97 | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | 432 5 1 | .. | .. | .. | .. | TOTAL | .. | 4,535 15 9 | 8,000 | 707 3 0 | 246 1 0 | No Spares, Land. | 349·30 | 13·64 | | | | | | | | | |
| Transit | .. | 268 2 1 | .. | .. | .. | .. | | | | | | | Rains | 51·45 | 2·02 | | | | | | | | | |
| General — Canvassing | .. | 198 4 5 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | | | Camp Movement. | 431·35 | 16·84 | | | | | | | | | |
| General — Organisation | .. | 29 4 3 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| General — Transport, Camping and Idle Time. | .. | 289 9 1 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| TOTAL | [785 3 9] | 5,294 2 1 | .. | .. | .. | 4,554 0 0 | Share chargeable to General Account. | | | | | | TOTAL | 2,563·30 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Season 1932-33.*

Period 2nd January 1933 to 1st May 1933.

| Tractor Unit No. I. | Direct Charges. | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| Lanz No. I. | Drivers' Wages. | Kerosene. | | Fuel. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | 139 6 11 | .. | .. | 1,108 | 430 10 6 | 116 | 310 4 3 | 61½ | 21 2 6 | .. | 50 1 3 | .. | 960 9 3 | 158·10 | 880-50 | 1 1 11 | 6 0 1 | 192 12 8 | 527 12 11 | 1,681 2 10 | 1 15 5 | 10 10 0 | 106 3 1 | 5 15 0 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | 7 13 10 | 30 | 16 14 0 | .. | .. | .. | .. | .. | .. | 354 7 5 | .. | .. | 379 3 3 | .. | 50-7 | .. | .. | .. | .. | 379 3 3 | .. | .. | 5 15 10 | 0 5 3 |
| Maintenance—Ploughs, etc. | 7 13 10 | 31½ | 17 9 3 | .. | .. | .. | .. | .. | .. | 522 9 0 | .. | .. | 548 0 1 | .. | 50-8 | .. | .. | .. | .. | 548 0 1 | .. | .. | 5 15 10 | 0 5 3 |
| Transit | 29 12 3 | .. | .. | 191 | 74 3 9 | 13½ | 23 7 0 | 8 | 2 12 0 | .. | .. | .. | 130 3 0 | .. | 189-25 | .. | .. | .. | .. | 130 3 0 | .. | .. | 22 10 7 | 1 3 9 |
| General—Rains | 23 11 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 23 11 8 | .. | 151-0 | .. | .. | .. | .. | 23 11 8 | .. | .. | 18 1 0 | 0 15 9 |
| General—No Spares, Land | 121 6 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 121 6 3 | .. | 772-30 | .. | .. | .. | .. | 121 6 3 | .. | .. | 92 7 6 | 5 0 10 |
| General—Camping | 3 14 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 14 6 | .. | 25-0 | .. | .. | .. | .. | 3 14 6 | .. | .. | 2 15 10 | 0 2 7 |
| General—Idle Time | 112 13 10 | 46½ | 26 4 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 139 2 7 | .. | 717-25 | .. | .. | .. | .. | 139 2 7 | .. | .. | 85 14 0 | 4 10 10 |
| TOTAL | 440 13 1 | 108 | 60 12 0 | 1,299 | 504 14 1 | 129½ | 333 11 3 | 69½ | 23 14 6 | 877 0 5 | 50 1 3 | [927 3 4] | 2,306 2 7 | 158·10 | 2,842-25 | .. | .. | 192 12 8 | 527 12 11 | 3,026 12 2 | .. | .. | 340 3 8 | 18 9 3 |

Profit or Loss.

| Tractor Unit No. I. | | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Transit and General. | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase Price. | Estimated Life of— | Depreciation Rs. 616 per Hour. | Interest at Rate 6 per cent. per annum on the basis of 6 Ploughing months. | Condition. | No. of Hours. | Per-centage. | Description. | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. I. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. | Hrs. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30. | 4,551 13 8 | 8,000 | 527 12 11 | 192 12 8 | Ploughing 10" | 880-50 | 31·21 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | .. | 1,793 2 11 | 2 1 6 | 11 5 4 | 15 0 0 | 2,373 12 0 | Ploughs or Implements. | P. & O. Mouldboard No. 8. | 375 15 0 | | | | Maintenance Tractor. | 50-7 | 1·76 | Ploughing 10" | .. | .. | 1·25 | 7·00 | ·14 | ·79 | ·07 | ·39 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | | | | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | .. | 385 8 4 | .. | .. | .. | .. | TOTAL | .. | 4,927 13 5 | 8,000 | 527 12 11 | 192 12 8 | Maintenance Plough. | 50-8 | 1·76 | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | 554 5 2 | .. | .. | .. | .. | | | | | | | Transit | 189-25 | 6·66 | | | | | | | | | |
| Transit | .. | 154 1 4 | .. | .. | .. | .. | | | | | | | Rains | 151-0 | 5·31 | | | | | | | | | |
| General—Rains | .. | 42 12 5 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | | | No Spares Land. | 772-30 | 27·18 | | | | | | | | | |
| General—No Spares, Land | .. | 218 14 7 | .. | .. | .. | .. | | | | | | | Camp Movement. | 25-0 | ·88 | | | | | | | | | |
| General—Camping | .. | 7 0 11 | .. | .. | .. | .. | | | | | | | General | 717-25 | 25·24 | | | | | | | | | |
| General—Idle Time | .. | 229 11 5 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| TOTAL | [652 8 8] | 3,385 0 1 | .. | .. | .. | 2,373 12 0 | Share chargeable to General Account. | | | | | | TOTAL | 2,842-25 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Seasons 1931-32 and 1932-33.*

Period 11th December 1931 to 30th May 1932 and 2nd January 1933 to 1st May 1933.

| Tractor Unit No. II. | Direct Charges. | | | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Ratchur. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | | | | | | | | | | | | | | |
| Lanz No. 2. | Drivers' Wages. | Kerosene. | | Fuel. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision. Other Expense. |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 9" | 561 7 11 | 25 | 18 9 11 | 3,263½ | 1,412 13 10 | 237 | 703 6 0 | 132½ | 43 13 4 | .. | 134 5 1 | .. | 2,874 8 1 | 560·1 | 2,866-40 | 1 1 1 | 5 1 3 | 469 13 7 | 1,054 15 9 | 4,999 5 5 | 1 13 9 | 8 5 2 | 563 9 9 | 34 10 6 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | 67 15 5 | 28 | 15 2 11 | .. | .. | .. | .. | 4 | 1 6 0 | 688 8 5 | .. | .. | 773 0 9 | .. | 296-9 | .. | .. | .. | .. | 773 0 9 | .. | .. | 62 3 10 | 3 13 3 |
| Maintenance—Ploughs, etc. | 30 14 8 | 28½ | 15 5 6 | .. | .. | .. | .. | 4½ | 1 8 9 | 1,029 9 8 | .. | .. | 1,077 6 7 | .. | 147-26 | .. | .. | .. | .. | 1,077 6 7 | .. | .. | 31 1 11 | 1 14 7 |
| Transit | 54 11 1 | 7½ | 3 7 6 | 308½ | 132 4 8 | 25 | 66 4 6 | 28½ | 10 5 3 | .. | .. | .. | 267 1 0 | .. | 268-40 | .. | .. | .. | .. | 267 1 0 | .. | .. | 56 5 9 | 3 7 5 |
| General—Rains | 58 12 11 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 58 12 11 | .. | 288-15 | .. | .. | .. | .. | 58 12 11 | .. | .. | 60 8 2 | 3 11 6 |
| General—No Spares, Land | 196 1 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 196 1 6 | .. | 966-35 | .. | .. | .. | .. | 196 1 6 | .. | .. | 202 13 8 | 12 7 6 |
| General—Transport, Camping | 2 6 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 6 2 | .. | 9-0 | .. | .. | .. | .. | 2 6 2 | .. | .. | 1 15 4 | 0 1 11 |
| General—Idle Time | 157 9 6 | 18 | 9 3 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 166 13 1 | .. | 828-40 | .. | .. | .. | .. | 166 13 1 | .. | .. | 173 14 9 | 10 11 1 |
| TOTAL | 1,129 15 2 | 106½ | 61 13 5 | 357½ | 1,545 2 6 | 262 | 769 10 6 | 169½ | 57 1 4 | 1,718 2 1 | 134 5 1 | 1,850 7 4 | 5,416 2 1 | 560·1 | 5,491-25 | .. | .. | 469 13 7 | 1,054 15 9 | 7,540 15 5 | .. | .. | 1,152 9 2 | 70 13 0 |

Profit or Loss.

| Tractor Unit No. II. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Ratchur. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost, Purchase price. | Estimated Life of—— Hours. | Depreciation Rs. ·616 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 2. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 4,551 13 8 | | | | Ploughing 10". | 2,686-40 | 48·90 | Ploughing 6". | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 9" | .. | 5,597 9 8 | 2 1 4 | 9 14 3 | 15 0 0 | 8,400 6 0 | Ploughs or Implements | F. and O. Moulded Board. | 375 15 9 | 8,000 | 1,054 15 9 | 469 13 7 | Maintenance Tractor. | 296-9 | 5·40 | Ploughing 10". | ·01 | ·05 | 1·21 | 5·77 | ·09 | ·42 | ·05 | ·24 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 147-26 | 2·70 | Ploughing 12". | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | .. | 830 1 10 | .. | .. | .. | .. | | | | | | | Transit | 268-40 | 4·89 | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | 1,110 7 1 | .. | .. | .. | .. | | | | | | | Rains | 288-15 | 5·25 | | | | | | | | | |
| Transit | .. | 326 14 2 | .. | .. | .. | .. | TOTAL | .. | 4,927 13 5 | 8,000 | 1,054 15 9 | 469 13 7 | No Spares, Land. | 966-35 | 17·60 | | | | | | | | | |
| General—Rains | .. | 123 0 7 | .. | .. | .. | .. | | | | | | | Camp Movement. | 9-0 | ·17 | | | | | | | | | |
| General—No Spares, Land | .. | 411 6 8 | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years. | .. | .. | Remarks. General | 828-40 | 15·09 | | | | | | | | | |
| General—Transport, Camping | .. | 4 7 5 | .. | .. | .. | .. | | | | | | | TOTAL | 5,491-25 | 100 | | | | | | | | | |
| General—Idle Time | .. | 351 6 11 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| TOTAL | (1,217 13 9) | 8,764 6 4 | .. | .. | .. | 8,400 6 0 | Share chargeable to General Account. | | | | | | | | | | | | | | | | | |

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation) ;Seasons 1931-32 and 1932-33.*

Period 11th December 1931 to 24th May 1932 and 2nd January 1933 to 1st May 1933.

| Tractor Unit No. III. | Direct Charges. | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| Lanz No. 3. | Drivers' Wages. | Kerosene. | | Fuel. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | 526 8 5 | 18¾ | 12 12 3 | 2,977¾ | 1,273 14 8 | 226½ | 650 14 8 | 123 | 43 1 1 | .. | 134 6 1 | .. | 2,641 9 2 | 547·24 | 2,832·25 | 1 0 1 | 4 13 2 | 460 2 0 | 1,621 10 9 | 4,723 5 11 | 1 12 8 | 8 10 0 | 557 2 6 | 34 4 1 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | 52 2 3 | 24¾ | 14 5 6 | .. | .. | .. | .. | 6½ | 2 3 9 | 1,570 1 10 | .. | .. | 1,638 13 4 | .. | 235·52 | .. | .. | .. | .. | 1,638 13 4 | .. | .. | 49 14 6 | 3 1 1 |
| Maintenance—Ploughs, etc. | 34 7 3 | 25½ | 14 7 10 | .. | .. | .. | .. | 6¼ | 2 3 9 | 1,046 4 9 | .. | .. | 1,097 7 7 | .. | 165·38 | .. | .. | .. | .. | 1,097 7 7 | .. | .. | 35 0 7 | 2 2 5 |
| Transit | 54 10 11 | 7 | 4 14 9 | 293¼ | 127 4 6 | 29 | 83 0 0 | 52½ | 19 2 1 | .. | .. | .. | 289 0 3 | .. | 283·45 | .. | .. | .. | .. | 289 0 3 | .. | .. | 60 0 9 | 3 11 1 |
| General—Rains | 39 4 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 39 4 5 | .. | 237·0 | .. | .. | .. | .. | 39 4 5 | .. | .. | 50 2 2 | 3 1 4 |
| General—No Spares, Land | 211 8 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 211 8 2 | .. | 1,148·40 | .. | .. | .. | .. | 211 8 2 | .. | .. | 243 1 3 | 14 15 1 |
| General—Transport, Camping. | 1 4 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 4 6 | .. | 9·0 | .. | .. | .. | .. | 1 4 6 | .. | .. | 1 15 4 | 0 1 11 |
| General—Idle Time | 137 3 7 | 42½ | 25 12 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 163 0 2 | .. | 733·20 | .. | .. | .. | .. | 163 0 2 | .. | .. | 155 4 1 | 9 8 9 |
| TOTAL | 1,057 1 6 | 117¾ | 72 4 11 | 3,271 | 1,401 3 2 | 255½ | 733 14 8 | 188½ | 66 10 8 | 2,616 6 7 | 134 6 1 | 2,736 4 11 | 6,081 15 7 | 547·24 | 5,445·50 | .. | .. | 460 2 0 | 1,621 10 9 | 8,163 12 4 | .. | .. | 1,152 9 2 | 70 13 9 |

Profit or Loss.

| Tractor Unit No. III. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost, Purchase price. | Estimated Life of—— Hours. | Depreciation Rs. ·516 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 3. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | | Rs. A. P. | Rs. A. P. | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 4,551 13 8 | | | | Ploughing 10" | 2,632-25 | 48·34 | Ploughing 6". | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | .. | 5,314 12 6 | 2 0 4 | 9 11 3 | 15 0 0 | 8,214 0 0 | Ploughs | P. and O. Mould-Board No. 8. | | 8,000 | 1,621 10 9 | 460 2 0 | Maintenance Tractor. | 235·52 | 4·33 | Ploughing 10". | ·067 | ·03 | 1·13 | 5·44 | ·09 | ·41 | ·04 | ·22 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | or Implements | | 375 15 9 | | | | Maintenance Plough. | 165·38 | 3·04 | Ploughing 12". | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | .. | 1,091 12 11 | .. | .. | .. | .. | | | | | | | Transit | 283·45 | 5·21 | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | 1,132 10 7 | .. | .. | .. | .. | | | | | | | Rains | 237·0 | 4·35 | | | | | | | | | |
| Transit | .. | 352 12 1 | .. | .. | .. | .. | TOTAL | .. | 4,927 13 5 | 8,000 | 1,621 10 9 | 460 2 0 | No Spares, Land. | 1,148·40 | 21·09 | | | | | | | | | |
| General—Rains | .. | 92 7 11 | .. | .. | .. | .. | | | | | | | Camp Movement. | 9·0 | ·17 | | | | | | | | | |
| General—No Spares, Land | .. | 469 8 6 | .. | .. | .. | .. | Camp | .. | 500 0 0 | 2 years. | .. | .. | | | | | | | | | | | | |
| General—Transport, Camping | .. | 3 5 9 | .. | .. | .. | .. | Equipment | | | | | | General | 733·20 | 13·47 | | | | | | | | | |
| General—Idle Time | .. | 327 13 0 | .. | .. | .. | .. | | | | | | | Remarks. TOTAL | 5,450·50 | 100 | | | | | | | | | |
| TOTAL | 1,245 15 3 | 9,387 3 3 | .. | .. | .. | 8,214 0 0 | Share chargeable to General Account. | | | | | | | | | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Seasons 1931-32 and 1932-33.*

Period 11th December 1931 to 30th May 1932 and 2nd January 1933 to 1st May 1933.

| Tractor Unit No. IV. | Direct Charges. | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Labour. | Fuel—Lubricants. | | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre | Supervisors' Salaries. | Supervision, Other Expense. |
| Lanz No. 4. | Drivers' Wages. | Kerosene. | | Fuel. | Rate. | Lubricating Oil. | Rate. | Grease | Rate. | | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | 442 0 4 | 27 | 18 15 9 | 2,540 | 942 1 6 | 148½ | 451 8 0 | 112½ | 39 12 9 | | .. | 101 8 0 | .. | 1,095 14 4 | 441·5 | 2,195·25 | 0 14 7 | 4 8 5 | 469 13 7 | 1,352 6 0 | 3,818 1 11 | 1 11 11 | 8 10 0 | 387 15 3 | 24 5 8 |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | 41 6 7 | 5 | 3 8 3 | .. | .. | .. | .. | 2 | 0 11 0 | | 311 5 11 | .. | .. | 356 15 9 | .. | 185·30 | .. | .. | .. | .. | 356 15 9 | .. | .. | 32 12 2 | 2 1 9 |
| Maintenance — Ploughs, etc. | 25 13 9 | 4½ | 3 2 7 | .. | .. | .. | .. | 2 | 0 11 0 | | 776 12 6 | .. | .. | 806 7 10 | .. | 126·15 | .. | .. | .. | .. | 806 7 10 | .. | .. | 22 4 8 | 1 7 0 |
| Transit | 41 7 5 | 6½ | 4 6 2 | 224 | 100 11 0 | 26½ | 86 2 6 | 25 | 8 15 9 | | .. | .. | .. | 241 10 10 | .. | 192·35 | .. | .. | .. | .. | 241 10 10 | .. | .. | 34 0 3 | 2 3 0 |
| General — Rains | 11 11 6 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 11 11 6 | .. | 44·45 | .. | .. | .. | .. | 11 11 6 | .. | .. | 7 12 6 | 0 8 0 |
| General — No Spares, Land | 256 5 5 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 256 5 5 | .. | 2,219·15 | .. | .. | .. | .. | 256 5 5 | .. | .. | 392 2 11 | 25 4 0 |
| General — Transport, Camping. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General — Idle Time | 91 1 9 | 6½ | 4 6 2 | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 95 7 11 | .. | 474·0 | .. | .. | .. | .. | 95 7 11 | .. | .. | 83 12 5 | 6 0 4 |
| Total | 969 14 9 | 49 | 34 6 11 | 2,764 | 1,042 12 6 | 175 | 537 10 6 | 141½ | 50 2 6 | | 1,088 2 5 | 101 8 0 | [1,163 7 7] | 3,764 9 7 | 441·5 | 5,437·45 | .. | .. | 469 13 7 | 1,352 6 0 | 5,586 13 2 | .. | .. | 960 12 2 | 61 13 9 |

Profit or Loss.

| Tractor Unit No. IV. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost, Purchase price. | Estimated Life of — Hours. | Depreciation Rs. ·616 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 4. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 4,551 13 8 | 8,000 | 1,352 6 0 | 469 13 7 | Ploughing 10" | 2,195·25 | 40·38 | Ploughing 6". | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 10" | .. | 4,230 6 10 | 1 14 10 | 9 9 1 | 15 0 0 | 6,616 14 0 | Ploughs | P. and O. Mould-Board No. 8. | | | | | Maintenance Tractor. | 185·30 | 3·41 | Ploughing 10". | ·01 | ·06 | 1·16 | 5·76 | ·07 | ·34 | ·05 | ·26 |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | or Implements | | 375 15 9 | | | | Maintenance Plough. | 126·15 | 2·32 | Ploughing 12". | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | .. | 391 13 8 | .. | .. | .. | .. | | | | | | | Transit | 195·35 | 3·54 | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | 830 3 6 | .. | .. | .. | .. | | | | | | | Rain | 44·45 | ·81 | | | | | | | | | |
| Transit | .. | 277 14 1 | .. | .. | .. | .. | Total | .. | 4,927 13 5 | 8,000 | 1,352 6 0 | 469 13 7 | No Spares, Land. | 2,219·15 | 40·82 | | | | | | | | | |
| General — Rains | .. | 20 0 0 | .. | .. | .. | .. | | | | | | | Camp Movement. | .. | .. | | | | | | | | | |
| General — No Spares, Land | .. | 673 12 4 | .. | .. | .. | .. | Camp Equipment | .. | 500 0 0 | 2 years. | .. | .. | Remarks. General | 474·0 | 8·72 | | | | | | | | | |
| General — Transport Camping | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| General — Idle Time | .. | 185 4 8 | .. | .. | .. | .. | Share chargeable to General Account. | | | | | | Total | 5,437·45 | 100 | | | | | | | | | |
| Total | [1,156 15 1] | 6,609 7 1 | .. | .. | .. | 6,616 14 0 | | | | | | | | | | | | | | | | | | |

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Seasons 1931-32 and 1932-33.*

Period 19th April 1932 to 16th June 1932 and 2nd January 1933 to 1st May 1933.

| Tractor Unit No. V. | | Direct Charges. | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| Lanz No. 5. | | Drivers' Wages. | Kerosene. | | Fuel. | Rate. | Lubricating Oil. | Rate. | Grease.* | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | Ploughing 10" | 213 0 5 | 7 | 4 14 9 | 1,102½ | 462 12 6 | 88½ | 251 3 4 | 61½ | 21 8 2 | .. | 108 0 5 | .. | 1,061 7 7 | 176·38 | 891-15 | 1 3 1 | 6 0 0 | 298 1 9 | 549 0 2 | 1,008 9 6 | 2 2 3 | 10 12 7 | 153 8 9 | 9 0 9 |
| | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance | Tractor | 27 1 9 | 15½ | 8 15 6 | .. | .. | .. | .. | 4½ | 1 7 4 | 521 7 6 | .. | .. | 558 15 1 | .. | 87-45 | .. | .. | .. | .. | 558 15 1 | .. | .. | 15 1 6 | 0 14 3 |
| | Ploughs, etc. | 13 0 10 | 15½ | 8 9 9 | .. | .. | .. | .. | 4 | 1 6 0 | 300 2 3 | .. | .. | 323 2 10 | .. | 53-15 | .. | .. | .. | .. | 323 2 10 | .. | .. | 9 2 8 | 0 10 0 |
| Transit | : : : : | 35 8 6 | 2½ | 1 9 4 | 153½ | 63 14 11 | 14½ | 43 3 10 | 16½ | 5 13 5 | .. | .. | .. | 150 2 0 | .. | 141-55 | .. | .. | .. | .. | 150 2 0 | .. | .. | 24 7 1 | 1 7 1 |
| General | Rains | 28 2 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 28 2 9 | .. | 172-45 | .. | .. | .. | .. | 28 2 9 | .. | .. | 29 5 1 | 1 12 1 |
| | No Spares, Land | 249 13 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 249 13 0 | .. | 1,605-15 | .. | .. | .. | .. | 249 13 0 | .. | .. | 276 10 8 | 16 4 10 |
| | Transport, Camping. | 2 9 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 9 6 | .. | 17-0 | .. | .. | .. | .. | 2 9 6 | .. | .. | 2 15 11 | 0 2 10 |
| | Idle Time | 145 13 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 145 13 0 | .. | 577-20 | .. | .. | .. | .. | 145 13 0 | .. | .. | 99 12 6 | 5 12 3 |
| | TOTAL | 715 1 9 | 40½ | 24 1 4 | 1,256 | 526 11 5 | 103 | 294 7 2 | 82½ | 30 2 11 | 821 9 9 | 108 0 5 | [882 2 11] | 2,620 1 9 | 176·38 | 3,546-30 | .. | .. | 298 1 9 | 549 0 2 | 3,367 3 8 | .. | .. | 611 0 2 | 36 0 1 |

Profit or Loss.

| Tractor Unit No. V. | | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost. Purchase price. | Estimated Life of —— Hours. | Depreciation Rs. ·616 per Hour. | Interest at Rate 6 per cent. per Annum on the basis of 6 ploughing months. | | | | | Fuel. | | | | Lubricating Oil. | | Grease. | |
| Lanz No. 5. | | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre | Per Hour. | Per Acre. |
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation | Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 4,551 13 8 | 8,000 | 549 0 2 | 298 1 9 | Ploughing 10" | 891-15 | 25·13 | Ploughing 6". | .. | .. | .. | .. | .. | .. | .. | .. |
| | Ploughing 10" | .. | 2,071 3 0 | 2 5 2 | 11 11 4 | 15 0 0 | 2,654 4 0 | Ploughs or Implements | P. and O. Mould-Board No. 8. | 375 15 9 | | | | Maintenance Tractor. | 87-45 | 2·47 | Ploughing 10". | ·01 | ·04 | 1·24 | 0·23 | ·10 | ·50 | ·07 | ·35 |
| | Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 53-15 | 1·50 | Ploughing 13". | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance | Tractor | .. | 574 14 10 | .. | .. | .. | .. | | | | | | | Transit | 141-55 | 4·00 | | | | | | | | | |
| | Ploughs, etc. | .. | 332 15 6 | .. | .. | .. | .. | | | | | | | Rains | 172-45 | 4·87 | | | | | | | | | |
| Transit | | .. | 176 0 2 | .. | .. | .. | .. | TOTAL | .. | 4,927 13 5 | 8,000 | 549 0 2 | 298 1 9 | No Spares, Land. | 1,605-15 | 45·28 | | | | | | | | | |
| General | Rains | .. | 59 3 11 | .. | .. | .. | .. | | | | | | | Camp Movement. | 17-0 | ·49 | | | | | | | | | |
| | No Spares, Land | .. | 542 12 6 | .. | .. | .. | .. | Camp | .. | 500 0 0 | 2 years. | .. | .. | | | | | | | | | | | | |
| | Transport, Camping | .. | 5 12 3 | .. | .. | .. | .. | Equipment | | | | | | Remarks. General | 577-20 | 16·26 | | | | | | | | | |
| | Idle Time | .. | 251 5 9 | .. | .. | .. | .. | | | | | | | TOTAL | 3,546-30 | 100 | | | | | | | | | |
| | TOTAL | [1,035 2 7] | 4,014 3 11 | .. | .. | .. | 2,654 4 0 | Share chargeable to General Account. | | | | | | | | | | | | | | | | | |

* Maintenance, Interest, Depreciation and General Charges are allocated *Pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

*Amalgamated Revised Statement (including Interest and Depreciation), Seasons 1931-32 and 1932-33.*

Period 12th April 1932 to 24th May 1932 and 2nd January 1933 to 1st May 1933.

| Tractor unit No. VI. | Direct Charges. | | | | | | | | | | | | | Cost Summary Direct Charges | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision Other Expense. |
| Lanz No. 6. | Drivers' Wages. | Kerosene. | | Fuel | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | 244 7 1 | 6½ | 4 8 9 | 1,538 | 613 14 5 | 142 | 401 3 11 | 90½ | 31 7 2 | .. | 109 6 11 | .. | 1,405 0 3 | 251·37 | 1,328-35 | 1 0 11 | 5 0 4 | 260 13 8 | 813 6 6 | 2,484 4 5 | 1 13 11 | 9 13 9 | 231 10 8 | 13 10 5 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | 16 13 11 | 26½ | 15 1 10 | .. | .. | .. | .. | 1½ | 0 8 3 | 501 8 6 | .. | .. | 624 0 6 | .. | 86-37 | .. | .. | .. | .. | 624 0 6 | .. | .. | 14 14 5 | 0 14 1 |
| Maintenance—Ploughs, etc. | 14 12 2 | 25½ | 14 7 9 | .. | .. | .. | .. | 1½ | 0 8 3 | 415 3 5 | .. | .. | 444 15 7 | .. | 77-38 | .. | .. | .. | .. | 444 15 7 | .. | .. | 13 8 0 | 0 12 9 |
| Transit | 31 4 2 | 1½ | 0 14 0 | 100½ | 62 8 10 | 11 | 26 14 0 | 4½ | 1 9 10 | .. | .. | .. | 123 2 10 | .. | 163-15 | .. | .. | .. | .. | 123 2 10 | .. | .. | 28 7 6 | 1 10 10 |
| General—Rains | 24 14 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 24 14 5 | .. | 144-0 | .. | .. | .. | .. | 24 14 5 | .. | .. | 25 1 9 | 1 7 8 |
| General—No spares, Land | 207 5 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 207 5 2 | .. | 1,029-30 | .. | .. | .. | .. | 207 5 2 | .. | .. | 179 9 1 | 10 9 4 |
| General—Camping | 1 9 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 9 4 | .. | 9-0 | .. | .. | .. | .. | 1 9 4 | .. | .. | 1 9 5 | 0 1 5 |
| General—Idle time | 136 2 0 | 7 | 3 15 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 140 1 0 | .. | 666-30 | .. | .. | .. | .. | 140 1 0 | .. | .. | 116 3 4 | 6 13 7 |
| TOTAL | 677 4 3 | 66½ | 38 15 4 | 1,638½ | 676 7 3 | 153 | 428 1 11 | 96½ | 34 1 6 | 1,006 11 11 | 109 6 11 | 1,069 0 11 | 2,071 1 1 | 251·37 | 3,504-5 | .. | .. | 260 13 8 | 813 6 6 | 4,050 5 3 | .. | .. | 611 0 2 | 36 0 1 |

Profit or Loss.

| Tractor Unit No. VI. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | No. of Hours. | Per-centage. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Raichur. | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost purchase Price. | Estimated Life of——— | Depreciation Rs. ·616 per Hour. | Interest at Rate 6% per Ann. on the basis of 6 ploughing months. | | | | | Fuel. | | | | Lub. Oil. | | Grease. | |
| Lanz No. 6. | | | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hrs. | Rs. A. P. | Rs. A. P. | | H. M. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | .. | .. | .. | .. | .. | .. | Tractor | Lanz 15/30 | 4,551 13 8 | 8,000 | 818 6 6 | 260 13 8 | Ploughing 10" | 1,328-35 | 37·91 | Ploughing 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 10" | .. | 2,729 9 6 | 2 0 10 | 10 13 4 | 15 0 0 | 3,778 14 0 | Ploughs or Implements | P. & O. Mould board Nos. | 375 15 9 | | | | Maintenance Tractor. | 85-37 | 2·44 | Ploughing 10" | ·005 | ·03 | 1·16 | 6·10 | ·11 | ·56 | ·07 | ·36 |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | Maintenance Plough. | 77-38 | 2·21 | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | .. | 639 13 0 | .. | .. | .. | .. | | | | | | | Transit | 163-15 | 4·66 | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | 459 4 4 | .. | .. | .. | .. | Total | .. | 4,927 13 5 | 8,000 | 818 6 6 | 260 13 8 | Rains | 144-0 | 4·11 | | | | | | | | | |
| Transit | .. | 153 5 2 | .. | .. | .. | .. | | | | | | | No Spares, Land | 1,029-30 | 29·39 | | | | | | | | | |
| General—Rains | .. | 51 7 10 | .. | .. | .. | .. | Camp Equipment. | .. | 500 | 2 years | .. | .. | Camp movement | 9-0 | ·26 | | | | | | | | | |
| General—No spares, Land | .. | 397 7 7 | .. | .. | .. | .. | | | | | | | General | 666-30 | 19·02 | | | | | | | | | |
| General—Camping | .. | 3 4 2 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| General—Idle time | .. | 263 1 11 | .. | .. | .. | .. | | | | | | | | | | | | | | | | | | |
| TOTAL | 868 10 8 | 4,697 5 6 | .. | .. | .. | 3,778 14 0 | Share chargeable to General Account. | | | | | | TOTAL | 3,504-5 | 100 | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of Hours employed on each operation.

O

# TRACTOR OPERATING STATEMENT.

## Period 20th February 1931 to 3rd February 1932.

| Tractor—John Deere 'D' model. | Direct Charges. | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dadu, Padidan Lundo (Sind). | Labour. | Fuel—Lubricants. | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| John Deere mould board and disc Ransomes disc, 2-Furrow International. | Drivers' Wages. | Petrol. | | Fuel or K. Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation—Ploughing 6" | 762 8 4 | 86·83 | 135 9 6 | 2,676·83 | 1,997 10 10 | 433·60 | 564 5 11 | 130·32 | 58 9 0 | .. | .. | 1,867 3 7 | 5,385 15 2 | 760·218 | 1,196·35 | 4 8 0 | 7 1 4 | 393 3 8 | 514 11 5 | 6,236 14 3 | 5 4 2 | 8 4 8 | 1,092 8 2 | 512 7 5 |
| Operation—Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | 79 12 0 | 7·25 | 10 15 11 | 39·25 | 34 2 9 | .. | .. | 47·25 | 8 9 10 | 1,290 4 7 | 114 0 11 | .. | .. | .. | 101·30 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Ploughs, etc. | 29 7 5 | .. | .. | .. | .. | .. | .. | .. | .. | 275 5 5 | 24 8 9 | .. | .. | .. | 37·30 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Transit | 3 4 0 | 0·17 | 0 4 0 | 7·67 | 5 13 8 | 3·65 | 5 4 4 | 0·43 | 0 3 6 | .. | .. | .. | 14 13 6 | .. | 1·0 | .. | .. | .. | .. | 14 13 6 | .. | .. | .. | .. |
| General—Canvassing | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General—Organisation | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General—Transport, Camping and Idle time. | 221 5 6 | .. | .. | 21·50 | 17 12 1 | .. | .. | .. | .. | .. | .. | .. | 239 1 7 | .. | 11·0 | .. | .. | .. | .. | 239 1 7 | .. | .. | 284 2 5 | 106 9 11 |
| TOTAL | 1,096 5 3 | 94·25 | 146 13 5 | 2,745·25 | 2,055 7 4 | 437·25 | 569 10 3 | 178·00 | 67 6 4 | 1,565 10 0 | 138 9 8 | 1,867 3 7 | 5,639 14 3 | 760·218 | 1,347·35 | .. | .. | 393 3 8 | 514 11 5 | 6,547 13 4 | .. | .. | 1,376 10 7 | 619 1 4 |

Profit or Loss.

| Tractor—John Deere 'D' Model. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location Dadu, Padidan Lundo (Sind). | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost purchase Price. | Estimated Life of——— | Depreciation Rs. 6236/12000 Hour. | Interest at Rate 6% per Annum on the basis of 6 ploughing months. | | | Fuel. | | | | Lub. Oil. | | Grease. | |
| John Deere mould board and disc Ransomes disc, 2-Furrow International. | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hrs. | Rs. A. P. | Rs. A. P. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation—Ploughing 6" | 644 11 5 | 8,543 9 3 | 7 2 3 | 11 5 11 | 8 0 0 | 6,081 11 11 | Tractor | John Deere 'D' model. | 3,590 0 0 | 12,000 | 514 11 5 | 393 3 8 | | Ploughing 6" | 2·24 | 3·56 | ·07 | ·11 | ·37 | ·57 | ·11 | ·18 |
| Operation—Ploughing 9" | .. | .. | .. | .. | .. | .. | Ploughs or Implements | Ransomes Plough. | 857 14 0 | | | | | Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation—Ploughing 12" | .. | .. | .. | .. | .. | .. | | John Deere disc. | 700 7 0 | | | | | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance—Tractor | .. | .. | .. | .. | .. | .. | | John Deere mould-board. | 450 0 0 | | | | | | | | | | | | | |
| Maintenance—Ploughs, etc. | .. | .. | .. | .. | .. | .. | | 2-Furrow International. | 638 1 0 | | | | | | | | | | | | | |
| | | | | | | | Total | | .. | 6,236 6 0 | .. | 514 11 5 | 393 3 8 | | | | | | | | | |
| Transit | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General—Canvassing | .. | .. | .. | .. | .. | .. | Camp Equipment. | | .. | 500 0 0 | 2 years | .. | .. | | | | | | | | | |
| General—Organisation | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General—Transport, Camping and Idle time. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| TOTAL | 644 11 5 | 8,543 9 3 | .. | .. | .. | 6,081 11 11 | Share chargeable to General Account. | | | | | | | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

## Period 22nd May 1931 to 10th December 1931.

| Tractor Unit No. Marshall Diesel 15/30. | Direct Charges. | | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges, Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Padidan—Govt. Auxiliary Farm Lundo (Sind). | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | | | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| 2-Furrow International mould-board. | Drivers' Wages. | Petrol. | | Fuel or K. Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | Allocation Maintenance Cost.* | Total. | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | 263 7 9 | 191 | 78 8 5 | 97 | 46 15 8 | 44½ | 70 0 8 | 33 | 9 8 2 | .. | .. | 428 3 6 | 896 12 2 | 99 | 221 | 4 0 11 | 9 0 11 | 233 15 11 | 100 12 11 | 1,231 9 0 | 5 9 2 | 12 7 0 | 249 11 9 | 183 0 0 |
| Operation — Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | 89 5 4 | .. | .. | 16½ | 14 5 0 | 3 | 7 13 6 | 6 | 1 1 6 | 174 9 6 | 10 15 0 | .. | .. | .. | 67 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Ploughs, etc. | 41 14 0 | .. | .. | .. | .. | .. | .. | .. | .. | 49 11 1 | 38 8 7 | .. | .. | .. | 31-30 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Transit | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General — Canvassing | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General — Organisation | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| General — Transport, Camping and Idle time. | 189 12 5 | .. | .. | 14 | 11 6 0 | .. | .. | .. | .. | .. | .. | .. | 201 2 5 | .. | 2 | .. | .. | .. | .. | 201 2 5 | .. | .. | 262 14 3 | 28 15 8 |
| TOTAL | 584 7 6 | 191 | 78 8 5 | 127½ | 72 10 8 | 47½ | 77 14 2 | 39 | 10 9 8 | 224 4 7 | 49 7 7 | 428 3 6 | 1,097 14 7 | 99 | 321-30 | .. | .. | 233 15 11 | 100 12 11 | 1,432 11 5 | .. | .. | 512 10 0 | 211 15 3 |

Profit or Loss.

| Tractor Unit No. Marshall Diesel 15/30. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Padidan—Govt. Auxiliary Farm Lundo (Sind). | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost purchase price. | Estimated Life of— | Depreciation at Rate— Amount per Annum or Rs.— per hour. | Interest at Rate— per Annum or Rs.— per month on the basis of 6 ploughing months. | | | Fuel. | | | | Lub. Oil. | | Grease. | |
| 2-Furrow International mould board. | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hrs. | Rs. A. P. | Rs. A. P. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | 492 15 11 | 2,157 5 0 | 9 12 2 | 21 12 8 | 8 0 0 | 702 0 0 | Tractor | Marshall Diesel. | 4,837 0 0 | 12,000 | 100 12 11 | 233 15 11 | Remark. | Ploughing 6" | ·44 | ·98 | .. | .. | ·19 | ·42 | ·15 | ·33 |
| Operation — Ploughing 9" | .. | .. | .. | .. | .. | .. | Ploughs or Implements. | International mould board 2-Furrows. | 638 1 0 | | | | | Ploughing 9" | .. | .. | | .. | .. | .. | .. | .. |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | | | | | | | | Ploughing 12" | .. | .. | | .. | .. | .. | .. | .. |
| Maintenance — Tractor | .. | .. | .. | .. | .. | .. | Total | .. | 5,475 1 0 | 12,000 | 100 12 11 | 233 15 11 | | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| Transit | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General — Canvassing | .. | .. | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years | .. | .. | | | | | | | | | | |
| General — Organisation | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General — Transport, Camping and Idle time. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| TOTAL | 492 15 11 | 2,157 5 0 | .. | .. | .. | 702 0 0 | Share chargeable to General Account. | | | | | | | | | | | | | | | |

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of Hours employed on each operation.

# TRACTOR OPERATING STATEMENT.

## Period 20th February 1931 to 30th June 1931.

| Tractor Unit No. 4 McCormick Deering 22/36. | Direct Charges. | | | | | | | | | | | | | Cost Summary Direct Charges. | | | | Overhead Charges Owner-Operator. | | | Cost Summary Owner-Operator. | | Overhead Charges Contractor-Operator. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dadu (Sind). | Labour. | Fuel—Lubricants. | | | | | | | | Materials. | | Allocation Maintenance Cost.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. | Supervisors' Salaries. | Supervision, Other Expense. |
| International 2-Furrow mould board. | Drivers' Wages. | Petrol. | | Fuel or K. Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | | |
| | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Gallons. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| Operation — Ploughing 6" | 343 8 0 | .. | .. | 12,90·17 | 1,065 2 4 | 122·97 | 187 15 2 | 103·13 | 51 9 0 | .. | .. | 753 14 11 | 2,402 1 5 | 334·029 | 528·5 | 4 8 9 | 7 3 0 | 245 9 7 | 252 14 6 | 2,990 9 6 | 5 7 11 | 8 10 11 | 396 0 2 | 114 13 2 |
| Operation — Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | .. | .. | .. | .. | .. | .. | .. | .. | .. | 687 1 10 | 66 13 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Ploughs, etc. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | |
| Transit | 5 12 1 | .. | .. | 10·83 | 8 15 2 | 1·03 | 1 9 3 | ·87 | 0 7 0 | .. | .. | .. | 16 11 6 | .. | .. | .. | .. | .. | .. | 16 11 6 | .. | .. | .. | .. |
| General — Canvassing | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 404 6 0 | 151 11 8 |
| General — Organisation | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | |
| General — Transport, Camping and Idle time. | 461 8 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 461 8 3 | .. | .. | .. | .. | .. | .. | 461 8 3 | .. | .. | | |
| TOTAL | 810 12 4 | .. | .. | 1,301·00 | 1,074 1 6 | 124·00 | 189 8 5 | 104·00 | 52 0 0 | 687 1 10 | 66 13 1 | 753 14 11 | 2,880 5 2 | 334·029 | 528·5 | .. | .. | 245 9 7 | 252 14 6 | 3,378 13 3 | .. | .. | 710 6 2 | 266 8 10 |

Profit or Loss.

| Tractor Unit No. 4 McCormick Deering 22/36. | Transit and General. | Final Cost Summary Contractor-Operator. | | | Memorandum. | | Data. | | | | | | Condition. | Description. | Consumption. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location—Dadu (Sind). | | Total. | Cost per Hour. | Cost per Acre. | Rate per Acre per Hour. | Earnings. | Item. | Description. | Cost purchase price. | Estimated life of——— | Depreciation at Rate——per Annum or Rs.——per month. Amount per Annum or Rs.——per month. | Interest at Rate——per Annum or Rs.——per month on the basis of 6 ploughing months. | | | Fuel. | | | | Lub. Oil. | | Grease. | |
| International 2-Furrow mould board. | | | | | | | | | | | | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | Hrs. | Rs. A. P. | Rs. A. P. | | | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Lbs. | Lbs. |
| Operation — Ploughing 6" | 1,034 5 5 | 4,355 12 3 | 8 4 0 | 13 0 8 | 8 0 0 | 2,672 3 9 | Tractor | McCormick Deering. | 5,108 14 0 | 12,000 | 252 14 6 | 245 9 7 | | Ploughing 6" | 2·44 | 3·86 | .. | .. | ·23 | ·37 | ·20 | ·31 |
| Operation — Ploughing 9" | .. | .. | .. | .. | .. | .. | Ploughs or Implements. | | | | | | | Ploughing 9" | .. | .. | .. | .. | .. | .. | .. | .. |
| Operation — Ploughing 12" | .. | .. | .. | .. | .. | .. | | International 2-Furrow mould board. | 638 1 0 | | | | | Ploughing 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| Maintenance — Tractor | .. | .. | .. | .. | .. | .. | Total | .. | 5,746 15 0 | 12,000 | 252 14 6 | 245 9 7 | | | | | | | | | | |
| Maintenance — Ploughs, etc. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| Transit | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General — Canvassing | .. | .. | .. | .. | .. | .. | Camp Equipment. | .. | 500 0 0 | 2 years | .. | .. | | | | | | | | | | |
| General — Organisation | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| General — Transport, Camping and Idle time. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | |
| TOTAL | 1,034 5 5 | 4,355 12 3 | .. | .. | .. | 2,672 3 9 | Share chargeable to General Account. | | | | | | | | | | | | | | | |

Profit or Loss.

* Maintenance, Interest, Depreciation and General Charges are allocated *pro rata* to No. of Hours employed on each operation.

# APPENDIX B.

## Tractor Specifications.

# SPECIFICATIONS OF KEROSENE TRACTORS.

| —— | Case Model "C". | Case Model "CC". | Case Model "L". | McCormick-Deering 10/20. |
|---|---|---|---|---|
| No. of Cylinders | 4. | 4. | 4. | 4. |
| Bore | 3⅞". | 3⅞". | 4⅛". | 4¼". |
| Stroke | 5½". | 5½". | 6". | 5". |
| Crankshaft Speed | 1,100 R.P.M. | 1,100 R.P.M. | 1,100 R.P.M. | 1,000 R.P.M. |
| Lubrication | Force Feed. | Force Feed. | Force Feed. | Gear Pump and Splash. |
| Oil Cleaner | Filter. | Filter. | Filter. | |
| Cooling | Centrifugal water pump and fan. | Centrifugal water pump and fan. | Centrifugal water pump and fan. | Radiator, Fan and Impeller. |
| Cooling Capacity | 4·16 gallons. | 4·16 gallons. | 10·5 gallons. | 9·5 gallons. |
| Capacity of Fuel Tank | 15 gallons. | 15 gallons. | 21⅛ gallons. | 12 gallons. |
| Clutch | Twin disc, hand controlled. | Twin disc, hand controlled. | Twin disc, hand controlled. | Single plate, dry. |
| Advertised speeds | 2½ m.p.h., 3½ m.p.h., 4½ m.p.h., 2½ m.p.h. reverse. | 2⅝ m.p.h., 3⅝ m.p.h., 5½ m.p.h., 2⅝ m.p.h. reverse. | 2½ m.p.h., 3½ m.p.h., 4 m.p.h., 2⅜ m.p.h. reverse. | 2 m.p.h., 3 m.p.h., 4 m.p.h., 2⅜ m.p.h. reverse. |
| Weight | 3,450 lbs. | 3,850 lbs. | 4,815 lbs. | 3,925 lbs. |
| Max. Pull in lbs.— Low | 3,289 lbs. low. | 2,950 lbs. low. | 4,555 lbs. low. | 3,050 lbs. low. |
| Second | 2,358 lbs. second. | 2,038 lbs. second. | 3,427 lbs. second. | 1,960 lbs. second. |
| Top | 1,525 lbs. top. | 1,187½ lbs. top. | 2,645 lbs. top. | 1,240 lbs. top. |
| Max. H. P.— Belt Pulley | 29·81 h.p. | 29·97 h.p. | 44·01 at 1,100 R.P.M. | 24·00 h.p. |
| Drawbar | 21·41 h.p. | 22·70 h.p. | 30·08 at 1,100 R.P.M. | 19·00 h.p. |
| Full lbs. per H. P. hour (Rated Load Test). | ·621 to ·652. | ·621 to ·652. | ·70. | ·89 (Belt) and 1·49 (Drawbar). |
| Agents | Martin & Co., Calcutta and Lahore, Masseys, Ltd., Madras. | Martin & Co., Calcutta and Lahore, Masseys Ltd., Madras. | Martin & Co., Calcutta and Lahore, Masseys Ltd., Madras. | Volkart Bros., Bombay. |
| Type of Engine | Kerosene starting on petrol. | Kerosene starting on petrol. | Case heavy duty vertical. | Heavy duty 4 cylinder (removable sleeve) valve-in-head type, mounting lengthwise, heavy duty crankshaft mounted on ball bearings, high tension with built in impulse starter, co-ordinated carburettion, factory sealed governor built integral with engine. |
| Track or Wheel | Wheel type (or track). | Wheel type (or track). | Wheels 48"d. 12" face with lugs. | Wheel 45½ front and 48 rear. |

## SPECIFICATIONS OF KEROSENE TRACTORS—*contd.*

| —— | McCormick-Deering 15/30. | Farmall. | McCormick-Deering Trac-Tractor T.20. | John Deere. |
|---|---|---|---|---|
| No. of Cylinders | 4. | 4. | 4. | 2. |
| Bore | 4¾". | 3¾". | 3¾". | 6¾". |
| Stroke | 6". | 5". | 5". | 7". |
| Crankshaft Speed | 1,000 R. P. M. | 1,200 R. P. M. | 1,250 R. P. M. | 800 R. P. M. |
| Lubrication | Gear Pump and Splash. | Gear Pump and Splash. | Gear Pump and Splash. | Force Feed, Gear Pump. |
| Oil Cleaner | .... | .... | .... | None. |
| Cooling | Radiator, Fan and Impeller cooling pump. | Radiator, Fan and Impeller cooling pump. | Radiator, Fan and Impeller cooling pump. | Tubular Radiator Thermo-siphon and fan (gear driven). |
| Cooling Capacity | 10 gallons. | 9 gallons. | 9 gallons. | 13 gallons. |
| Capacity of Fuel Tank | 16 gallons. | 10 gallons. | 22 gallons. | 21 gallons. |
| Clutch | Single plate, dry. | Single plate, dry. | Single plate, dry. | 12" Dry discs locking in and out. |
| Advertised speeds | 2½ m.p.h., 3½ m.p.h., 4 m.p.h., 2¾ m.p.h. reverse. | 2 m.p.h., 3 m.p.h., 4 m.p.h., 2½ m.p.h. reverse. | 1¾ m.p.h., 2¾ m.p.h., 3¾ m.p.h., 2 m.p.h. reverse. | 2½ m.p.h., 3¼ m.p.h., 2 m.p.h. reverse. |
| Weight | 5,800 lbs. | 3,630 lbs. | 6,350 lbs. | 4,917 lbs. |
| Max. Pull in lbs.— | | | | |
| Low | 3,912 lbs. low. | 2,510 lbs. low. | 5,156 lbs. low. | 4,462·5 lbs. at 2·4 m.p.h. |
| Second | 2,840 lbs. second. | 1,680 lbs. second. | 3,160 lbs. second. | (Has only 2 speeds.) |
| Top | 2,250 lbs. top. | 970 lbs. top | 2,007 lbs. top. | 3,090 lbs. at 3·75 m.p.h. |
| Max. H. P.— | | | | |
| Belt Pulley | 40 h.p. | 18 h.p. | 24 h.p. | 36·98 h.p. |
| Drawbar | 30 h.p. | 13 h.p. | 32 h.p. | 28·53 h.p. |
| Fuel lbs. per H. P. hour (Rated Load Test). | ·73 (Belt) and 1·21 (Drawbar) | ·77 (Belt) and 1·23 (Drawbar). | ·93 (Drawbar). | 0·744 lbs. |
| Agents | Volkart Bros., Bombay. | Volkart Bros., Bombay. | Volkart Bros., Bombay. | William Jacks & Co., Karachi. |
| Type of Engine | Same as 10/20. | Same as 10/20. | Same as 10/20. | Two Stroke. |
| Track or Wheel | Wheel 52" front and 53" rear. | Wheel 10" front and 74" rear. | Track Tread width 41½" and length 52½". | Wheel. |

## SPECIFICATIONS OF KEROSENE TRACTORS—*contd.*

| —— | Caterpillar 15. | Caterpillar 20. | Caterpillar 25. | Caterpillar 30. |
|---|---|---|---|---|
| No. of Cylinders | 4. | 4. | 4. | 4. |
| Bore | 3¾". | 3¾". | 4". | 4¾". |
| Stroke | 4". | 5". | 5½". | 6½". |
| Crankshaft Speed | 1,500 R.P.M. | 1,250 R. P. M. | 1,100 R. P. M. | 850 R. P. M. |
| Lubrication | Force feed. | Force feed. | Force feed. | Force feed. |
| Oil Cleaner | Own make. | Own make. | Own make. | Own make. |
| Cooling | Pump. | Pump. | Pump. | Pump. |
| Cooling Capacity | .... | .... | .... | 9 gallons. |
| Capacity of Fuel Tank | 16¼ gallons. | 20 gallons. | 20⅝ gallons. | 37 gallons. |
| Clutch | Dry plate master. | Dry plate master. | Dry plate master. | Dry plate master. |
| Advertised speeds | 20 m.p.h., 2·6 m.p.h., 3·5 m.p.h., 2·1 m.p.h. reverse. | 2·0 m.p.h., 2·6 m.p.h., 3·6 m.p.h., 2·1 m.p.h. reverse. | 1·8 m.p.h., 2·6 m.p.h., 3·6 m.p.h., 2·0 m.p.h. reverse. | 1·7 m.p.h., 2·6 m.p.h., 3·6 m.p.h., 2·0 m.p.h. reverse. |
| Weight | 4·461 lbs. | 5,900 lbs. | 7,670 lbs. | 10,160 lbs. |
| Max. Pull in lbs.— | | | | |
| Low | 2,330 lbs. low. | 4,160 lbs. low. | 5,640 lbs. low. | 5,560 lbs. low. |
| Second | 2,215 lbs. second. | 3,200 lbs. second. | 3,920 lbs. second. | 3,525 lbs. second. |
| Top | 1,635 lbs. top. | 2,310 lbs. top. | 2,790 lbs. top. | 2,180 lbs. top. |
| Max. H. P.— | | | | |
| Belt Pulley | 18 h.p. | 25 h.p. | 30 h.p. | 38·2 h.p. |
| Drawbar | 15 h.p. | 22 h.p. | 26 h.p. | 32·8 h.p. |
| Fuel lbs. per H. P. hour (Rated Load Test). | .... | .... | .... | ·85 lbs. per H. P. hour. |
| Agents | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. |
| Type of Engine | Kerosene, four cycle water cooled. | Kerosene, four cycle water cooled. | Kerosene, four cycle water cooled. | Kerosene, four cycle water cooled. |
| Track or Wheel | Track. | Track. | Track. | Track. |

## SPECIFICATIONS OF KEROSENE TRACTORS—*concld.*

| | Caterpillar 35. | Caterpillar 50. | Caterpillar 70. |
|---|---|---|---|
| No. of Cylinders | 4. | 4. | 4. |
| Bore | 4¼". | 5¼". | 7". |
| Stroke | 6½". | 6½". | 8½". |
| Crankshaft Speed | 850 R. P. M. | 850 R. P. M. | 700 R. P. M. |
| Lubrication | Force Feed. | Force Feed. | Force Feed. |
| Oil Cleaner | Own make. | Own make. | Own make. |
| Cooling | Pump. | Pump. | Pump. |
| Cooling Capacity | .... | .... | 25 gallons. |
| Capacity of Fuel Tank | 41½ gallons. | 54½ gallons. | 75 gallons. |
| Clutch | Dry plate master. | Dry plate master. | Dry plate master. |
| Advertised speeds | 1·7 m.p.h., 2·5 m.p.h., 3·2 m.p.h., 4·6 m.p.h., 1·9 m.p.h. reverse. | 1·6 m.p.h., 2·4 m.p.h., 3·4 m.p.h., 4·7 m.p.h., 1·9 m.p.h. reverse. | 1·7 m.p.h., 2·3 m.p.h., 2·7 m.p.h., 3·1 m.p.h., 3·7 m.p.h., 5·0 m.p.h., Reverse 1·7 m.p.h., 2·7 m.p.h. |
| Weight | 12,280 lbs. | 17,190 lbs. | 29,500 lbs. |
| Max. Pull in lbs.— | | | |
| Low | 8,265 lbs. low. | 11,800 lbs. low. | 17,200 lbs. low. |
| Second | 5,625 lbs. second. | 7,590 lbs. second. | 12,400 lbs. second. |
| Third | 4,300 lbs. third. | 5,485 lbs. third. | 10,410 lbs. third. |
| Fourth | 3,055 lbs. (top). | 3,985 lbs. (top). | 8,690 lbs. fourth. |
| Fifth | .... | .... | 6,975 lbs. fifth. |
| Top | .... | .... | 4,630 lbs. top. |
| Max. H. P.— | | | |
| Belt Pulley | 41 h.p. | 55 h.p. | 87 h.p. |
| Drawbar | 37 h.p. | 50 h.p. | 76 h.p. |
| Fuel lbs. per H. P. hour (Rated Load Test). | .... | .... | .... |
| Agents | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. |
| Type of Engine | Kerosene four cycle water cooled. | Kerosene four cycle water cooled. | Kerosene four cycle water cooled. |
| Track or Wheel | Track. | Track. | Track. |

## SPECIFICATIONS OF DIESEL TRACTORS.

| —— | Mercedes Benz. | Marshall. | Munktells 30 H. P. | Munktells 40 H. P. |
|---|---|---|---|---|
| No. of Cylinders | 1. | 1. | 2. | 2. |
| Bore | 5·9". | 8". | 6 5/16". | 7 7/16". |
| Stroke | 9·45". | 10½". | 7 7/16". | 8". |
| Crankshaft Speed | 800 R. P. M. | 550 R. P. M. | 700 R. P. M. | 650 R. P. M. |
| Lubrication | Force feed. | Mechanical. | Force feed, Mechanical. | Force feed, Mechanical. |
| Oil Cleaner | Hirth. | Marshall. | Ganze Filters. | Ganze Filters. |
| Cooling | Fan and Pump. | Thermo-syphon with pump. | Radiator. | Radiator. |
| Cooling Capacity | 10 gallons. | .... | 8·5 gallons. | 10·5 gallons. |
| Capacity of Fuel Tank | 9 gallons. | 12 gallons (approx.). | 20·4 gallons. | 26·4 gallons. |
| Clutch | Single disc dry. | Cone, foot operated. | Dry plate. | Dry plate. |
| Advertised speeds | 1·9 m.p.h., 2·8 m.p.h., 3·85 m.p.h., 2·5 m.p.h. reverse. | 2 m.p.h., 3 m.p.h., 4 m.p.h., 2·5 m.p.h. reverse. | 2·17 m.p.h., 2·79 m.p.h., 3·60 m.p.h., 1·61 m.p.h. reverse. | 2·23 m.p.h., 2·08 m.p.h., 3·72 m.p.h., 1·67 m.p.h. reverse. |
| Weight | 6,100 lbs. | 6,048 lbs. | 5,235 lbs. | 6,930 lbs. |
| Max. Pull in lbs.— | | | | |
| Low | 2,500 lbs. at 1·88 m.p.h. | 4,000 lbs. approx., low. | 2,750 lbs. low. | 3,740 lbs. low. |
| Second | 1,980 lbs. at 2·89 m.p.h. | .... | 2,200 lbs. second. | 2,860 lbs. second. |
| Top | 1,430 lbs. at 3·26 m.p.h. | .... | 1,650 lbs. top. | 2,310 lbs. top. |
| Max. H. P.— | | | | |
| Belt Pulley | 23·9 h.p. | 27 h.p. | 30 h.p. | 40 h.p. |
| Drawbar | 13·9 h.p. | .... | 17½ h.p. | 22½ h.p. |
| Fuel lbs. per H. P. hour (Rated Load Test). | 0·81 lbs. per H. P. hour. | 0·48 lbs. per B. H. P. hour. | ·57 lbs. | ·57 lbs. |
| Agents | Greaves Cotton & Co., Bombay. | Marshall Sons & Co. (India), Ltd., Bombay. | Macbeth Bros. & Co., Ltd., Bombay. | Macbeth Bros. & Co., Ltd., Bombay. |
| Type of Engine | Diesel. | Semi Diesel, 2 Stroke. | Two Stroke. | Two Stroke. |
| Track or Wheel | Wheel. | Wheel. | Wheel. | Wheel. |

## SPECIFICATIONS OF DIESEL TRACTORS—*contd.*

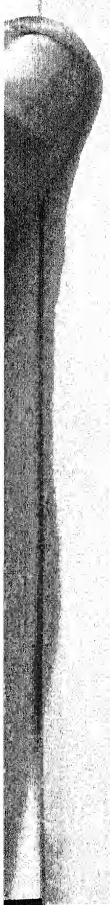
| | Caterpillar 35 " Diesel ". | Caterpillar 50 " Diesel ". | Caterpillar 75 " Diesel ". | Lanz. |
|---|---|---|---|---|
| No. of Cylinders | 3. | 4. | 6. | 1. |
| Bore | 5¼". | 5¼". | 5¼". | 8·85". |
| Stroke | 8". | 8". | 8". | 10·2". |
| Crankshaft Speed | 850 R. P. M. | 850 R. P. M. | 820 R. P. M. | 540 R. P. M. |
| Lubrication | Force Feed. | Force Feed. | Force Feed. | Force Feed. |
| Oil Cleaner | Own make. | Own make. | Own make. | Own Gange. |
| Cooling | Pump. | Pump. | Pump. | Fan and Thermo-syphon. |
| Cooling Capacity | 13⅓ gallons. | 15 gallons. | 23½ gallons. | 13½ gallons. |
| Capacity of Fuel Tank | 37½ gallons. | 50 gallons. | 75 gallons. | 13½ gallons. |
| Clutch | Dry plate master. | Dry plate master. | Dry plate master. | 3 Jaw clutch. |
| Advertised speeds | 1·7 m.p.h., 2·5 m.p.h., 3·2 m.p.h., 4·6 m.p.h., 1·9 m.p.h. reverse. | 1·6 m.p.h., 2·4 m.p.h., 3·4 m.p.h., 4·7 m.p.h., 1·9 m.p.h. reverse. | 1·7 m.p.h., 2·3 m.p.h., 2·7 m.p.h., 3·1 m.p.h., 3·7 m.p.h. 5·0 m.p.h., Reverse 1·7 m.p.h., 2·7 m.p.h. | 2·0 m.p.h., 3·25 m.p.h., 4·0 m.p.h., 2·1 m.p.h. reverse. |
| Weight | 13,900 lbs. | 18,900 lbs. | 30,550 lbs. | 6,200 lbs. |
| Max. Pull in lbs.— | | | | |
| Low | 8,749 lbs. low. | 12,878 lbs. low. | 19,625 lbs. low. | 4,050 lbs. low. |
| Second | 5,914 lbs. second. | 7,973 lbs. second. | 14,160 lbs. second. | 2,980 lbs. second. |
| Third | 4,280 lbs. third. | 5,344 lbs. third. | 11,890 lbs. third. | 1,870 lbs. top. |
| Fourth | 2,752 lbs. top. | 3,569 lbs. top. | 9,930 lbs. fourth. | .... |
| Fifth | .... | .... | 7,960 lbs. fifth. | .... |
| Top | .... | .... | 5,280 lbs. top. | .... |
| Max. H. P.— | | | | |
| Belt Pulley | 46·08 h.p. | 60·13 h.p. | 93 h.p. | 31 h.p. |
| Drawbar | 38·65 h.p. | 52·65 h.p. | 80 h.p. | 23·2 h.p. |
| Fuel lbs. per H. P. hour (Rated Load Test). | .... | .... | .... | 0·86 lbs. per H. P. hour. |
| Agents | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. | William Jacks & Co., Bombay. | Jessop & Co., Ltd., Calcutta. |
| Type of Engine | Diesel, four cycle water cooled. | Diesel, four cycle water cooled. | Diesel, four cycle water cooled. | Semi-diesel 2 stroke. |
| Track or Wheel | Track. | Track. | Track. | Wheel. |

## SPECIFICATIONS OF DIESEL TRACTORS—*concld.*

| | Hanomag Diesel 36 H. P.] |
|---|---|
| No. of Cylinders | 4. |
| Bore | 4⅛". |
| Stroke | 5⅝". |
| Crankshaft Speed | 1,100 R. P. M. |
| Lubrication | Force Feed. |
| Oil Cleaner | .... |
| Cooling | Water Pump, Radiator and Fan. |
| Cooling Capacity | 10 gallons (approx.). |
| Capacity of Fuel Tank | 18½ gallons. |
| Clutch | Elastic single disc dry. |
| Advertised speeds | 1·9 m.p.h., 3·0 m.p.h., 5·0 m.p.h., 1·2 m.p.h. reverse. |
| Weight | 5,600 lbs. |
| Max. Pull in lbs.— | |
| Low | .... |
| Second | .... |
| Top | .... |
| Max. H. P.— | |
| Belt Pulley | .... |
| Drawbar | .... |
| Fuel lbs. per H. P. hour (Rated Load Test) | 0·5 lbs. per h. p. hour. |
| Agents | Kurt Wobad and Willie Endler, Engineers, P. B. 372, Bombay. |
| Type of Engine | Diesel. |
| Track or Wheel | Wheel. |

# APPENDIX C.

## Report on Tractor Ploughing work during 1933-34 Season.



# APPENDIX C.

## REPORT OF THE TRACTOR PLOUGHING WORK CARRIED OUT BY BURMAH SHELL OIL STORAGE AND DISTRIBUTING COMPANY OF INDIA, LIMITED, DURING THE 1933-1934 SEASON.

*Introductory.*—This is a report on the practical experimental work carried out during 1933-1934 season and is supplementary to the report for 1932-33 and for the combined seasons, 1930-1931-1932-1933, submitted to the Advisory Council in July 1933. As a result of a recommendation made by the Advisory Council at their meeting in July 1933, it was recommended that further experiments should be continued by Burmah-Shell in order to determine more accurately the working life of a tractor and to carry out further experimental work in connection with plough shares, which had formed a heavy item of expenditure during the past three season's work. In view of the fact that the tractors that had been worked the longest were the Lanz diesel tractors and, as it was generally considered that diesel tractors were likely to be more economical for use in India, it was hoped that further data could be acquired regarding the Lanz tractors, but, due to the inability of the owners of the tractors in question, *viz.*, H. E. H. the Nizam of Hyderabad's Government and Messrs. Jessop and Co. Ltd., Calcutta, to lend them for the further work it was not possible to continue experimental work with these tractors and it was, therefore, decided to continue work with the Caterpillar 30 H. P. tractor which had been worked during the 1930-1931 and 1931-1932 seasons, and also with the 15/36 McCormick-Deering tractor which had been worked by the Dharwar Agricultural Association and by Burmah-Shell. Whilst it is to be regretted that diesel tractors could not be employed on the further experimental work now under review, it is felt that the figures obtained relating to kerosene tractors will be very fair indication of the life of a diesel tractor which should under no circumstances be less than that of a kerosene unit. Sufficient data is already available regarding the fuel costs and consumption of diesel tractors and is contained in the report submitted last year.

The Imperial Council of Agricultural Research made a grant of Rs. 7,000 towards the costs of the experiments, of which approximately Rs. 13,892 was spent, leaving a balance of Rs. 1,250 to be returned to the Imperial Council of Agricultural Research. This balance would have been larger if two tractors could have been employed throughout the season, as supervision and other overhead charges would then have been divided over the output of the two outfits.

*Tractors and Implements Employed.*—A 30 H. P. Caterpillar Kerosene tractor and a 15/36 McCormick-Deering tractor were employed together with No. 5 and No. 8 P. and O. ploughs ; work up to 10″ only was carried out. Tests were carried out, as detailed later,

with a dynamometer kindly loaned by the Director of Agriculture, Bombay Presidency, and it was found that the Caterpillar tractor which had worked for three seasons, had a maximum drawbar pull of 6,048 lbs. working down to 10″ and of 6,608 lbs. down to 12″, with a three furrow mould-board plough. As the manufacturers only claim a maximum drawbar pull of 8,000 lbs. this is a remarkable testimony to the tractor. The Lanz tractors originally proposed to be used were of 15 H. P. only and the drawbar tests could not have been carried out with these tractors. As a result of the drawbar tests it can definitely be said that the Lanz tractors were under-powered for the work carried out and it is very doubtful whether they would have stood up a further season's work under such strenuous conditions, but in any case they could only have worked a one furrow plough. For these further reasons it can, therefore, be considered satisfactory that the Lanz diesel tractors already mentioned were not utilised although under more favourable soil conditions such as existed during the experimental work at Raichur, they would show successful results. The working life of the Caterpillar tractor previous to the season under review was approximately 2,400 hours, of which approximately 1,200 hours was spent on deep ploughing and the remainder on road grading and other work. The ploughs utilised were not sufficiently strong for the work, but consistent ploughing down to 10″ was carried out and although this type of ploughs would not be recommended for any further work, they can be considered to have given satisfactory results.

The McCormick-Deering tractor was only worked for 11 days due to the final drive breaking down completely. This tractor was definitely underpowered for the work and in view of this and the fact that to put it in working repair a considerable expenditure would have been incurred, it was decided to continue the experiments with the Caterpillar tractor only. It was found that the furrow driving wheel of the McCormick-Deering tractor pressed a certain amount of the *hariali* ploughed land back into the furrow which would result in the *hariali* regerminating.

*Working Season.*—A working season of four months was estimated, *viz.*, from 1st December to 31st March, during which period it was hoped to obtain 100 working days of 20 hours each and to complete 600 acres. Due to exceptionally late rains work could not be started until the 1st of January and even then only 13 acres were completed before further unexpected rains started. Work did not really start in earnest until 11th January and finished on 29th March. During this period 543 acres were ploughed, which, considering that only one tractor was worked during the greater portion of the season and that our original estimate was 600 acres for two tractors, can be considered satisfactory. A total acreage of 543 acres was ploughed in 1,527 hours which is equivalent to ·355 acres per hour and 2 hours 49 minutes per acre. The figures for the previous three years' work were 0·305 acres per hour and 3 hours 17 minutes per acre. It will be seen, therefore, that a considerable improvement on working time was effected.

*Payment for work.*—In all Rs. 8,147-6-0 worth of work was carried out of which Rs. 1,926 was paid in cash by landlords and the balance of Rs. 6,221-6-0 paid to us by the Government of Bombay who will recover from landlords by means *Takavi*. The high

percentage of cash work is particularly noticeable and is evidence of the value attached by landlords and ryots to the type of work in the Dharwar District.

*Costing statement, fuel consumption and costs.*—The figures for 1930-1931 and 1931-1932 seasons were as follows :—

| — | Petrol (for starting). | | Kerosene. | | Lub. Oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|
| | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | | | Lbs. | Lbs. |
| Caterpillar 30 Consumption (Gallons). | ·446 | ·188 | 6·32 | 2·291 | ·454 | ·175 | ·365 | ·151 |
| Cost (Rs. a. p.) . . | 0 11 5 | 0 4 7 | 4 11 7 | 1 11 4 | 0 12 6 | 0 5 3 | 0 2 2 | 0 0 11 |

Similar figures for 1933-1934 season were :—

| — | Petrol (for starting). | | Kerosene. | | Lub. Oil. | | Grease. | |
|---|---|---|---|---|---|---|---|---|
| | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. | Per acre. | Per hour. |
| | | | | | | | Lbs. | Lbs. |
| Caterpillar 30. Consumption (Gallons) | ·495 | ·175 | 5·572 | 1·981 | ·537 | ·191 | ·882 | ·191 |
| Cost (Rs. a. p.) . . | 0 8 11* | 0 3 2 | 3 2 2 | 1 1 11 | 0 13 5 | 0 4 9 | 0 5 4 | 0 1 2 |

* Lower *cost* due to fall in market rates.

It will be noticed that the petrol consumption per acre was heavier in 1933-1934 than in past season and this was due to the numerous stoppages due to plough breakdowns ; the increased grease consumption was due to a new type of softer trac lubricant being used which required more frequent application but gave more satisfactory results. The increased lubricating oil consumption was due to the crankshaft journals being oval and this could not be renewed owing to the agents having none in stock. The kerosene oil consumption showed a considerable decrease during the 1933-1934 season and the figure of 1·981 gallons per hour can be taken as a very satisfactory consumption for a tractor of the power of Caterpillar 30. Two detailed costing statements are attached—one exclusive of depreciation, interest and supervision charges and the other inclusive of depreciation and interest charges.

*Life of tractor.*—The life of the Caterpillar tractor at the end of the 1933-1934 season was 3,280 hours working time, without taking into consideration time spent in transit·

The tractor at the end of the third season was in perfectly sound working condition and in dynamometer tests carried out at the end of March the maximum drawbar pull was 6,608 lbs. at 2,000 ft. above sea-level. The advertised maximum drawbar pull of a new tractor is 8,000 lbs. and therefore after allowing 9% at 2,000 ft. the drawbar pull of a new tractor claimed by manufacturers would be 7,280 lbs. The maximum drawbar pull claimed by the manufacturers for the Caterpillar 30 was 8,000 lbs. at sea-level and it will be seen, therefore, that the drawbar pull after nearly 4,000 hours work was 93·5 per cent. of the manufacturers' original claim. These figures are in themselves sufficient support of an estimate of 8,000 hours for the life of the tractor, since it can be safely assumed that the tractor will at least work as many hours again without any unreasonable expenditure on spare parts. During the three seasons work Rs. 717-13-2 has been spent in all on new parts for the tractor, of which only Rs. 43-3-0 was spent in the season under review.

*Dynamometer Tests.*—(*a*) As already mentioned above Dynamometer tests were carried out in March with the principal object of ascertaining the drawbar pull required for 10″ ploughing. These tests were not carried out until the end of the season in order that the moisture in the soil might have worked down as far as possible, thus ensuring the heaviest conditions under which tractors have to operate.

(*b*) *Type of soil.*—The area where the tests were carried out was deep black cotton soil free from decomposed lime deposits and was a good representative area of wheat and cotton land in the eastern dry tracts in the southern portion of the Bombay Presidency.

(*c*) *Crop.*—Wheat and safflower had been cultivated and this was selected in view of the wheat land always drying off more than cotton and *jowar* lands, on account of the number of harrowings given which result in the soil opening up at an early date.

(*d*) *Details of Tests.*—Five tests in all were carried out on the same plot of land which was sloping. Test No. 1 was carried out beginning at the bottom of the slope where there was thick *hariali* which was still slightly green. Test No. 2 was carried out on the upper slope and on the high level land which was free from *hariali*. Test No. 3 was also taken on the rising land which was free from *hariali*. Tests Nos. 4 and 5 were taken on the level highland free from *hariali*.

(*e*) *Depth of Furrows.*—The depth of the furrows was measured by the Tractor Canvassing Officer of the Department of Agriculture and he also checked the depth of moisture and the average of the maximum drawbar pull.

(*f*) *Implements used* :—

(1) *Ploughs.*—P. and O. No. 8 Three Furrow Mould-board Plough manufactured by the International Harvester Export Co., for whom Messrs. Volkart Bros. are Agents in India.

(2) *Tractor.*—(Caterpillar 30 H. P.) Tractor manufactured by the Caterpillar Tractor Co., U. S. A., for whom Agents in India are Messrs. William Jacks and Co., Bombay.

(*g*) *Results by Tests*—

| —— | Test No. 1. | Test No. 2. | Test No. 3. | Test No. 4. | Test No. 5. |
|---|---|---|---|---|---|
| Depth of Moisture . . | 8½/9″ | 11½″ | 11½″ | 10½″ | 12″ |
| Condition of Soil . . | Cracked ½″. | No cracks. | 1″ Cracks. | 2″ cracks. | 2″ cracks. |
| Amount of *hariali* . . | Heavy. | *Nil* | *Nil.* | *Nil.* | *Nil.* |
| Depth of Furrows . . | 11″ | 11½″ | 11″ | 11″ | 12″ |
| Number of bottoms . . | Three. | Three. | Three. | Three. | Three. |
| Width of bottom . . | 12″ | 12″ | 12″ | 12″ | 12″ |
| Total width of cut . . | 33″ | 33″ | 33″ | 33″ | 36″ |
| Average Draft . . . | 4,480 | 3,696 | 4,928 | 4,928 | 5,488 |
| Maximum Draft . . . | 5,992 | 4,816 | 6,048 | 6,048 | 6,608 |
| Draft per bottom . . | 1,493 | 1,292 | 1,643 | 1,643 | 1,829 |
| Tractive Resistance per inch cross Section. | 135 | 117 | 149 | 149 | 152 |

NOTE.—The maximum pull in each case is only for a fraction of a second and the draft per bottom and the tractive resistance per inch on the cross section are therefore all based on the average pull.

(*h*) *General.*—The following further data of interest was obtained during these tests. The drawbar power required per bottom for 12″ ploughing with No. 8 P. and O. 3-Furrow Plough is 1,829 lbs., after taking into consideration the fact that the test was carried out 2,000 ft. above sea-level.

The tractive resistance in the section where *hariali* was growing was the same as in the clean land—although the grass roots certainly cause more draft, this extra draft was made up in the clean land by the extra resistance caused by the moisture having worked lower. Since *hariali* is more prevalent in the lower areas of fields with its hollows and *nullahs* where the soil retains its moisture longer, the draft at the onset of the season when the average depth of the moisture is less will be heavier in those fields where the weed has obtained a stronger footing throughout.

*Plough Shares.*—One of the two main objects of the 1933-34 season's experimental work was to carry out further experimental work in connection with the life of plough shares and to ascertain more accurately the most efficient and economical type of share for use under the working conditions found in the black cotton soil tracts of the Dharwar District. During the season three different kinds of shares were tried out as follows :—

1. International Harvester Company (I. H. C.) Steel Shares (Agents :—Messrs. Volkart Brothers, manufactured by the International Harvester Export Co. in their P. and O. Works, Canada).

This share is a soft centred share, which is built in three sections—the front and back facings are of high grade, heat-treated chrome steel and the centre section is of soft steel. This construction is followed with the object of overcoming any shock the share may receive when it hits large stones or tree-roots underneath the surface. Share No. 1, sent as an exhibit to this report, shows the result of one of this type of share hitting a large underground rock. (The plough spring release was first put out of section in order to obtain this sample.)

2. Cooper Solid Steel Shares (imported by the Cooper Engineering Works, Satara, and manufactured by Messrs. Fritz Doring, 42, Potsammerstrasse, Berlin).

This share is a solid high tempered chrome steel share, and one of its outstanding points is that, although it is so hard a type of steel share, the shock from underground rocks and tree-roots does not result in any breakage or bending. Even after the share has been heated for resharpening the metal is so hard that it requires a long time for forging.

3. Cooper Cast Iron Chilled Shares (manufactured by the Cooper Engineering Works, Satara.)

These shares did not stand up to the conditions of the test due to their being too brittle.

Two separate tests were carried out—the first with two shares of the first two types mentioned above and the second with three shares of all three types abovementioned. The following is a summary of the hours and acres worked by each set of share :—

| Type of Share. | New Share. | | 1st sharpening. | | 2nd sharpening. | | 3rd sharpening. | | Total. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *First Tests.* | H. | Ac. | H. | Ac. | H. | Ac. | H. | Ac. | H. | Ac. | |
| I. H. C. Soft Centre Steel (2) | 44-00 | 11½ | 28-05 | 7½ | 91-50 | 24½ | 0-45 | .. | 164-40 | 43-30 | |
| Cooper Solid Steel (2) . | 67-20 | 17½ | 58-50 | 15½ | 15-30 | 4 | .. | | 141-40 | 37-20 | |
| *Second Tests.* | | | | | | | | | | | |
| I. H. C. Soft Central Steel (3) | 31-15 | 12½ | 66-55 | 26½ | 28-00 | 11½ | 20-00 | 8½ | 146-30 | 58½ | These shares were completely finished. |
| Cooper Solid Steel (3) . | 181-25 | 72½ | 91-40 | 36½ | 60-55 | 23½ | 34-55 | 14½ | 368-55 | 146-30 | These shares could still have been used but project closed. |
| Cooper C. I. Chilled (3) . | 9-35 | 3½ | .. | | .. | | .. | | 9-35 | 3-10 | These shares broke. |

The first tests were carried out with two-furrow P. and O. ploughs and the second tests with three-furrow P. and O. ploughs. The first test was carried out at the beginning of the season when the soil conditions changed so much that the results obtained from these tests are not of great value—for example, the I. H. C. soft centered steel shares could only be worked for 45 minutes after their third resharpening before they become useless. The Cooper solid steel shares were then worked under the same soil conditions and after their second resharpening only lasted for a further 15½ hours. As mentioned elsewhere in this report due to the late rains, ploughing work could not start in the true black cotton

soil belt until the second test was started and for these both types of shares were working under the same soil conditions. At the beginning of the second test the I. H. C. soft centered steel shares were first worked in a field of 100 acres, but had to be changed after completing 12½ acres which were ploughed in 31 hours 35 minutes. The Cooper solid steel shares were then worked under exactly the same conditions and did not require changing until 72¼ acres had been ploughed in 181 hours 25 minutes working time. The soil for this work was heavy in lime contents in certain sections. After the first resharpening the I. H. C. shares were next worked in good deep black cotton soil and lasted for 16½ acres or 66 hours 55 minutes, whilst the Cooper steel shares after their first resharpening were used for 36½ acres in 91 hours 49 minutes. During the second and third resharpening tests both types of shares were used under exactly the same soil conditions and as will be seen from the above summary the total acreage ploughed by the set of 3 I. H. C. shares was 58½ acres in 146 hours 30 minutes, and the Cooper shares were used for 147 acres in 368 hours 55 minutes. The solid steel shares, therefore, proved far more satisfactory both under good and poor soil conditions and the three solid steel shares could have been resharpened a fourth time and used for further work if the season had not closed.

*Summary.*—The results of the 1933-34 experimental work can be summarised as follows :—

1. *Life of Tractor.*—As the Caterpillar 30 Kerosene Tractor has completed nearly 4,000 hours and as its maximum drawbar pull under test was 93·5 per cent. of the manufacturer's original claim for the maximum drawbar pull of the new tractor and under Rs. 800 had been spent on renewals, a minimum economic working life of 8,000 hours can safely be assumed.

*Drawbar Pull* :—

(*a*) The drawbar required per bottom for 12" ploughing is 1,829 lbs. at 2,000 ft.

(*b*) The tractive resistance in sections where *hariali* grows is the same as in clean land and extra draft caused by grass roots is offset by the extra resistance caused by the moisture working lower down in clean land.

3. *Plough Shares.*—Solid steel shares are the most satisfactory type for deep-ploughing work in the conditions found in the Dharwar District.

4. *Fuel Consumption.* The kerosene consumption for the Caterpillar 30 should be in the neighbourhood of 1·9 gallons per hour and 5·5 gallons per acre. The cost of kerosene should be spproximately Rs. 1-1-11 per hour and Rs. 3-2-2 per acre.

E. MILLER,
*General Manager,*
*Development Department.*

BOMBAY ;
*1st May, 1934.*

*Explanatory note in connection with Tractor Operating Cost Statement for Caterpillar 30. Season 1933-34.*

*Petrol.*—This figure is for the petrol used in starting the tractor.

*Lubricating Oil.*—Engine Oil and Transmission Oil have been included under this heading.

*Grease.*—Grease and Trac Lubricant have been included under this heading.

*Spare Parts.*—All spare parts for the tractor and ploughs, including plough shares are included under this heading.

*Railway Freight and Transport.*—All railway freights on spare parts and oils, as well as the cost of sending the tractor to and from Gadag, transport on main and field roads and motor cycle expenditure incurred by the Supervisor are included.

*Depreciation.*—This item includes depreciation on two ploughs at 20%, part of the trailer at 20% and the Caterpillar tractor at Re. 1 per hour for 1,420 hours.

*Supervision—Other Expenses.*—The Supervisor's special allowance, railway expenses for the Supervisor and drivers, stamps, stationery and telegrams and Camp Clerk's salary are all included under this heading.

C. P. G. WADE,
for *General Manager,*
*Development Department.*

# TRACTOR OPERATING STATEMENT.

*Period 1st January 1934 to 28th March 1934.*

| TRACTOR UNIT No. I. | | DIRECT CHARGES. | | | | | | | | | | | | | | | | COST SUMMARY DIRECT CHARGES. | | | | OVERHEAD CHARGES OWNER-OPERATOR. | | | COST SUMMARY OWNER-OPERATOR. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location. Gadag. | | LABOUR. | FUEL—LUBRICANTS. | | | | | | | | | MATERIALS. | | R/F and Transport.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. |
| Caterpillar 30 H. P. | | Drivers' Wages. | Petrol. | | Fuel or K. Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | |
| | | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Lbs. | Rs. A. P. | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| | PLOUGHING 6" . | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| OPERATION | PLOUGHING 9" . | .. | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | PLOUGHING 10" . | 208 4 0 | 247½ | 268 6 6 | 2,664 | 1,602 8 3 | 239 | 355 1 6 | 411 | 84 4 0 | | .. | .. | 958 13 3 | 3,567 6 3 | 504—06½ | 1,334—30 | 2 10 9 | 7 1 3 | .. | .. | .. | .. | .. |
| | TRACTOR . . | 78 12 0 | .. | .. | 49½ | 29 12 4 | .. | .. | .. | .. | | 43 3 0 | 89 11 0 | 507 2 6 | 739 8 10 | .. | 335—00 | .. | 1 7 6 | .. | .. | .. | .. | .. |
| MAINTE-NANCE. | PLOUGHS, ETC. . | 30 3 9 | .. | .. | .. | .. | .. | .. | .. | .. | | 785 7 0 | 185 9 0 | 106 2 3 | 1,107 6 0 | .. | 136—35 | .. | 2 2 4 | .. | .. | .. | .. | .. |
| TRANSIT . | .... | 13 12 4 | 5½ | 5 13 3 | 153½ | 02 5 4 | 4½ | 8 6 0 | 5½ | 2 1 0 | | .. | .. | .. | 122 5 11 | .. | 85—30 | .. | 0 3 10 | .. | .. | .. | .. | .. |
| | RAINS . . . | 62 13 0 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 62 13 0 | .. | 160—50 | .. | 0 1 11 | .. | .. | .. | .. | .. |
| GENERAL . | CAMP MOVEMENT . | 7 12 9 | .. | .. | 68½ | 41 3 3 | .. | .. | .. | .. | | .. | .. | 10 9 0 | 59 9 0 | .. | 28—50 | .. | 0 1 10 | .. | .. | .. | .. | .. |
| | TRANSPORT, CAMPING & IDLE TIME. | 37 4 8 | .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | 37 4 8 | .. | 122—40 | .. | 0 1 2 | .. | .. | .. | .. | .. |
| TOTAL . | .... | 528 15 3 | 253½ | 274 3 9 | 2,935½ | 1,765 13 2 | 243½ | 363 7 6 | 416½ | 86 5 0 | | 828 10 0 | 206 4 0 | 1,582 11 0 | 5,696 5 8 | 504—06½ | 2,204—00 | .. | 11 3 10 | .. | .. | .. | .. | .. |

| TRACTOR UNIT No. I. | | OVERHEAD CHARGES CONTRACTOR-OPERATOR. | | TRANSIT & GENERAL. | FINAL COST SUMMARY CONTRACTOR-OPERATOR. | | | MEMORANDUM. | | DATA. | | | | | | CONDITION. | REMARKS. | DESCRIPTION. | CONSUMPTION. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location. Gadag. | | | | | TOTAL. | Cost per Hour. | Cost per Acre. | | | | | | | | | | | | FUEL. | | | | LUB. OIL. | | GREASE. | |
| Caterpillar 30 H. P. | | S per-visor's Salaries. | Super-vision. Other Expense. | | | | | Rate per Acre. | Earnings. | Item. | Description. | Cost purchase Price. | Estimated Life of 8,000 Hours. | Depreciation at Rate .... Amount per Annum or Re. 1 per hour. | Interest at Rate 6% per Annum or Rs..... per month. | | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | Rs. A. P. | | | | Gals. | Gals. | Gals. | Gals. | Gals. | Gals. | lbs. | lbs. |
| | PLOUGHING 6" . | | | | | | | | | TRACTOR | Caterpillar 30 H. P. No. 8. | 8,000 0 0 | 1,420 | 1,20 0 0 | 236 3 1 | | | PLOUGHING 6" . | .. | .. | .. | .. | .. | .. | .. | .. |
| OPERATION | PLOUGHING 9" . | | | | | | | | | PLOUGH OR | Two P. & O. No. 8. | 909 5 2 | .. | 20% 181 13 11 | 54 3 3 | | | PLOUGHING 10" | 2·00 | 5·285 | .. | .. | ·179 | ·474 | ·307 | ·815 |
| | PLOUGHING 10" . | | | | | | | 15 0 0 | 7,561 4 0 | TRAILER. | .. | 255 14 0 | .. | 51 2 10 | 13 5 8 | | | PLOUGHING 12" | .. | .. | .. | .. | .. | .. | .. | .. |
| | TRACTOR . . | | | | | | | .. | .. | | | | | | | | | | | | | | | | | |
| MAINTENANCE. | PLOUGHS, ETC. . | | | | | | | .. | .. | TOTAL . | .. | .. | .. | 1,653 0 9 | 306 2 0 | | | | | | | | | | | |
| TRANSIT . | .... | | | | | | | .. | .. | CAMP . . | .. | . | Rs. 50 being upkeep only. | | | | | | | | | | | | | |
| | RAINS . . . | | | | | | | .. | .. | EQUIPMENT. | | | | | | | | | | | | | | | | |
| GENERAL . | CAMP MOVEMENT . | | | | | | | .. | .. | | | | | | | | | | | | | | | | | |
| | TRANSPORT, CAMPING & IDLE TIME. | | | | | | | .. | .. | | | | | | | | | | | | | | | | | |
| TOTAL . | .... | | | | | | | 15 0 0 | 7,561 4 0 | SHARE CHARGEABLE TO GENERAL ACCOUNT. | | | | | | | | | | | | | | | | |

Profit or Loss

* R/F and Transport. This includes Rs. 448 being R/F to and from Bombay on Tractor.

# TRACTOR OPERATING STATEMENT. (*Including interest and depreciation.*)

*Period 1st January 1934 to 28th March 1934.*

| TRACTOR UNIT No. I. | | DIRECT CHARGES. | | | | | | | | | | | | | | | | COST SUMMARY DIRECT CHARGES. | | | | OVERHEAD CHARGES OWNER-OPERATOR. | | | COST SUMMARY OWNER-OPERATOR. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location. Gadag. | | LABOUR. | FUEL—LUBRICANTS. | | | | | | | | | MATERIALS. | | R/F and Transport.* | Total. | Acres Ploughed or Cultivated. | Time Worked in Hours. | Cost per Hour. | Cost per Acre. | Interest. | Depreciation. | Total. | Cost per Hour. | Cost per Acre. |
| Caterpillar 30. | | Drivers' Wages. | Petrol. | | K. Oil. | Rate. | Lubricating Oil. | Rate. | Grease. | Rate. | Spare Parts. | Repairs and Sundries. | | | | | | | | | | | | |
| | | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Gals. | Rs. A. P. | Lbs. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | H. M. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| | PLOUGHING 6" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| OPERATION | PLOUGHING 9" | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | PLOUGHING 10" | 298 4 0 | 247½ | 268 6 6 | 2,664 | 1,602 8 3 | 239 | 355 1 6 | 411 | 84 4 0 | .. | .. | .. | 958 13 3 | 3,567 6 3 | 504—6½ | 1,334—30 | 2 10 9 | 7 1 3 | 187 10 7 | 1,553 6 9 | 5,308 7 7 | 3 15 8 | 10 8·7 |
| MAINTE-NANCE. | TRACTOR | 78 12 0 | .. | .. | 49½ | 29 12 4 | .. | .. | .. | .. | 43 3 0 | 80 11 0 | 507 2 6 | 739 8 10 | .. | 335—00 | .. | 1 7 6 | 47 2 9 | .. | 786 11 7 | .. | 1 9 2 |
| | PLOUGHS, ETC. | 30 3 9 | .. | .. | .. | .. | .. | .. | .. | .. | 785 7 0 | 185 9 0 | 106 2 3 | 1,107 6 10 | .. | 136—35 | .. | 2 2 4 | 18 10 0 | 99 10 0 | 1,126 1 0 | .. | 2 3 9 |
| TRANSIT | .... | 13 12 4 | 5½ | 5 13 3 | 153½ | 92 5 4 | 4½ | 8 6 0 | 5½ | 2 1 0 | .. | .. | .. | 122 5 11 | .. | 85—30 | .. | 0 3 10 | 10 8 0 | .. | 232 7 11 | .. | 0 7 5 |
| | RAINS | 62 13 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 62 13 0 | .. | 160—50 | .. | 0 1 11 | 21 6 0 | .. | 84 3 0 | .. | 0 2 8 |
| GENERAL | CAMP MOVEMENT | 7 12 9 | .. | .. | 68½ | 41 3 3 | .. | .. | .. | .. | .. | .. | 10 9 0 | 59 9 0 | .. | 28—50 | .. | 0 1 10 | 3 8 1 | .. | 63 1 1 | .. | 0 2 2 |
| | TRANSPORT, CAMPING & IDLE TIME. | 37 4 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 37 4 8 | .. | 122—40 | .. | 0 1 2 | 17 3 7 | .. | 54 8 3 | .. | 0 1 3 |
| TOTAL | .... | 528 15 3 | 253½ | 274 3 9 | 2,935½ | 1,765 13 2 | 243½ | 363 7 6 | 416½ | 86 5 0 | 828 10 0 | 266 4 0 | 1,582 11 0 | 5,606 5 8 | 504—6½ | 2,204—00 | .. | 11 3 10 | 306 2 0 | 1,653 0 9 | 7,655 8 5 | .. | 15 3 0 |

| TRACTOR UNIT No. I. | | OVERHEAD CHARGES CONTRACTOR-OPERATOR. | | TRANSIT & GENERAL. | FINAL COST SUMMARY CONTRACTOR-OPERATOR. | | | MEMORANDUM. | | DATA. | | | | | | CONDITION. | DESCRIPTION. | CONSUMPTION. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location. Gadag. | | | | | | | | | | | | | | | | | | FUEL. | | | | LUB. OIL. | | GREASE. | |
| Caterpillar 30. | | Supervisor's Salaries. | Supervision. Other Expenses. | | TOTAL. | Cost per Hour. | Cost per Acre. | Rate per Acre. | Earnings. | Item. | Description. | Cost purchase Price. | Estimated Life of 8,000 Hours. | Depreciation at Rate... Amount per Annum or Re. 1 per hour. | Interest at Rate 6% per Annum or Rs..... per month. | | | Kerosene. | | Fuel Oil. | | | | | |
| | | | | | | | | | | | | | | | | | | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. | Per Hour. | Per Acre. |
| | | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | | | Rs. A. P. | | Rs. A. P. | Rs. A. P. | | | Gals. | Gals. | Gals. | Gals. | Gals. | Gals. | Lbs. | Lbs. |
| | PLOUGHING 6" | *N. B.*—It will be noted that supervision charges have been omitted as this scheme, being of an experimental nature, these charges were essentially out of all proportion to the needs of a scheme consisting of only two tractors. Actually the cost of supervision amounted to Rs. 6-12-0 per acre and we consider that a generous figure to include against supervision and allied charges for a scheme of this size would be Rs. 1-2-0 per acre. | | | | | | .. | .. | TRACTOR | Caterpillar. | 8,000 0 0 | 1,429 | 1,429 0 0 | 236 3 1 | | PLOUGHING 6" | .. | .. | .. | .. | .. | .. | .. | .. |
| OPERATION | PLOUGHING 9" | | | | | | | .. | .. | PLOUGHS | Two P. & O. No. 5. | | | 20% | | | PLOUGHING 9" | .. | .. | .. | .. | .. | .. | .. | .. |
| | PLOUGHING 10" | | | | | | | 15 0 0 | 7,561 4 0 | OR | | 909 5 2 | .. | 181 13 11 | 54 9 2 | | PLOUGHING 10" | 2·00 | 5·285 | .. | .. | ·479 | ·474 | ·367 | ·15 |
| | TRACTOR | | | | | | | .. | .. | IMPLEMENT . | Trailer . | 255 14 4 | .. | 51 2 10 | 15 5 8 | | | | | | | | | | |
| MAINTE-NANCE. | PLOUGHS, ETC. | | | | | | | .. | .. | TOTAL . | .. | 9,165 6 8 | .. | 1,653 0 9 | 306 2 0 | | | | | | | | | | |
| TRANSIT | .... | | | | | | | .. | .. | CAMP | .. | .. | Rs. 50 being upkeep only. | | | | | | | | | | | | |
| | RAINS | | | | | | | .. | .. | EQUIPMENT. | | | | | | | | | | | | | | | |
| GENERAL | CAMP MOVEMENT | | | | | | | .. | .. | | | | | | | | | | | | | | | | |
| | TRANSPORT, CAMPING & IDLE TIME. | | | | | | | .. | .. | | | | | | | | | | | | | | | | |
| TOTAL | .... | | | | | | | 15 0 0 | 7,561 4 0 | SHARE CHARGEABLE TO GENERAL ACCOUNT. | | | | | | REMARKS. | | | | | | | | | |

Loss Rs. 94-4-5.

*R/F and Transport. This includes Rs. 448 R/F to and from Bombay on Tractor.

MGIPC—M—III-1-17—11-3-35—650.